the OIL AND GAS JOURNAL

PUBLISHED WEEKLY JANUARY 4, 1960

New Electric Rig May Set Pattern

- Only two speed ratios
- Single ebullient cooling system
- Split d. c. generator output
- Lightweight V-type mud pump

p. 66

How top oil men see 1960 ▸ 43

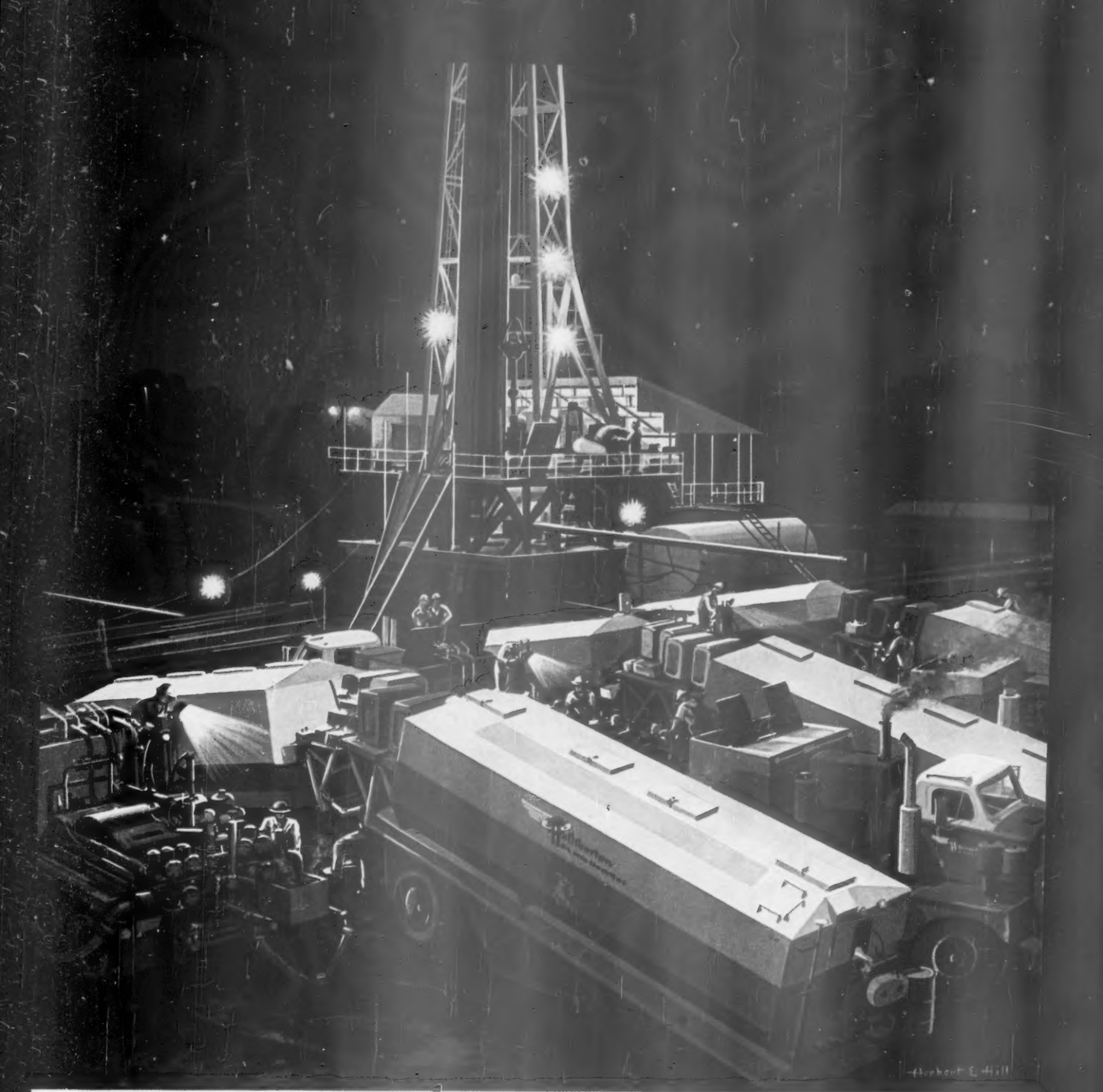
What those compact cars mean ▸ 46

Revolutionary new rig tested ▸ 48

Should geologists register? ▸ 52

How isotopes save money ▸ 54

1,000-well project begins ▸ 61



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Time doesn't matter when a well needs service, and Halliburton Services are designed to fill the entire needs of the oil patch.

HALLIBURTON OIL WELL CEMENTING COMPANY

DUNCAN, OKLAHOMA

OIL AND GAS JOURNAL
Vol. 58 No. 1

Contents January 4, 1960

THE WEEK'S NEWS

General Interest:
Top Oil Executives Look at 1960—and Beyond ... 43
U. S. Coal Lobby to Fight Canadian Gas Exports ... 50
Radioactive Isotopes Save Oil Industry Millions ... 54
Pipelines, Prices Mildly Criticized by Attorney General ... 58

Pipelining:
U. S. Coal Lobby to Fight Canadian Gas Exports ... 50
FPC Approval Brings El Paso-Pacific Northwest Merger Closer ... 51
FPC Considering El Paso's Plan to Drop Favored-Nation Clauses ... 59
Pipeline Briefs ... 58

Processing:
How Compact Cars Will Affect Oil ... 46
Texas Butadiene, Textile Fiber Firm Planning Merger ... 51

Drilling-Production:
Revolutionary New Rig May Solve Some Old Drilling Problems ... 48
Railroad Commission Approves Pan Am Flood in Three Bar Field ... 59

Foreign News:
Tension Mounts on the Iranian-Iraqi Border ... 60
Giant Argentine Drilling Program Is on Its Way ... 61
Mobil Enters Algeria by Buying Into Acreage Near Edjele ... 63
Shell Makes Application to Explore in Belgium ... 63
World Production ... 64

Exploration:
Geologists' Opinions Vary on Registration Proposal ... 52
Fifties Great for Oil Finding, Next Decade Could be Greater ... 115
A Closer Look at Oklahoma's Love County: Part I ... 116
Horseshoe Canyon Is Fast Growing New Mexico Oil Patch ... 124
Exploration Outlook ... 128

EVERY WEEK

Advertisers' Index ... 141
Book Review ... 78 & 81
Calendar of Events ... 36
Classified Advertising ... 138
Drilling Contractors ... 112
Drilling Statistics ... 134
Editorial ... 41
Equipment Men ... 108
Exploration Highlights ... 115
Foreign News ... 60
Foreman's Page ... 87
Cost Indexes ... 95
Journally Speaking ... 39
Markets ... 137
New Equipment ... 98
On the Job—Pipelining ... 96
Personals ... 129
Production ... 135
Refinery Cost Indexes ... 78
Refinery Oper. Index ... 78
Refining Statistics ... 136
Statistical Summary ... 133
Technical Questions ... 93
The Journal Said ... 39
They Say ... 35
Trade Literature ... 106
Watching Washington ... 50

Technology-Operation section on next page →

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Annual index available on request.

TECHNOLOGY—OPERATION

Drilling

New Electric Rig Breaks Precedent 66

By Ed McGhee

This deep-drilling draw works has only two speed ratios. It is likely the only electric rig now operating which can split the output of its d.c. generators. It is one of the few rigs in existence that has a single ebullient-cooling system for all rig engines. It is one of only a small number using a lightweight V-type mud pump.

Production

Tailor the Artificial-Lift System to the Job 79

By Robert W. Drake, Jr.

A new selection method which may seem tedious and unnecessary to some engineers and production men is recommended when dealing with wells which require deeper pumping, and where long reservoir life is to be expected. Significant savings can be made by a comparison study which includes a detailed analysis of every possible type of lift.

Pipelining

Electric-Reciprocating Compressor-Powered Station 73

By Kenneth W. Robertson

The initial installation at the Freeburg compressor station of Illinois Power Co. includes two 700-hp. electric-motor-driven compressors, compressor auxiliaries, and a complete triethylene glycol natural-gas-dehydration unit. A complete control system permits automatic operation of the compressor. Station horsepower will ultimately total 2,800.

Lube Tests Reveal Compressor-Engine Wear 96

By D. V. Kniebes

A 2-year study of the wear history of 84 pipeline compressor engines demonstrates the feasibility of using lubricating-oil analyses as a means of detecting increased rate of wear of engine components before their failure in service.

Refining-Processing

Radioactive Tracers Pinpoint Entrainment of Vacuum-Still Bottoms 70

By G. B. Hoekstra, A. I. Snow, L. A. Baillie, and J. S. Curtice

This was proved in studies made at Sinclair Research Laboratories over a wide range of still loadings. The tracer was radioactive cobalt-60 naphthenate. Flash tests showed that it had negligible volatility at still operating conditions. Effectiveness of tracer study was proved by color comparison of overhead gas oil. Part 1 of two parts.

New Gas Treater for Small-Volume Gasoline Recovery 76

By R. J. Hull

This treater has proved economical in the range of 500 M.c.f.d. at 1.0 to 2.0 gal. of gasoline per M.c.f., up to 5,000 M.c.f.d. at 0.5 gal. of gasoline per M.c.f. Several plants are now in operation. The unit dehydrates gas and extracts pentanes and heavier, somewhat to the exclusion of butane and propane. Usually a single product of about 20-lb. R.v.p. is made.

Nelson Refinery Cost Indexes 78

How Imperial's Compressors Cope with 165° F. Temperature Variations 84

By D. J. McEachern

These extreme temperature variations encountered in the three western Canadian provinces call for especially designed building foundations, jacket-water coolers, lube-oil systems, and other accessory equipment.

The Foreman's Page 87

Pressures produced by liquids.

Progress Report on Acetylene 88

By Marcel J. P. Bogart

Nearly a dozen methods are available today for the conversion of hydrocarbons to acetylene. These range from the original commercial arc process pioneered in Germany to pilot-plant and commercial development on regenerative cracking and partial combustion of hydrocarbons by American and foreign firms.

Questions on Technology 93

Char value or wick char of kerosine.—References to questions on wax.

Tube Extractor Assists Refinery Maintenance Job 94

This device which can be hung from an ordinary yard crane can pull tube bundles, lower them to the ground, and later raise them again.

Quarterly Costimating 95

The OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
Jan. 4, 1960

Many majors are staging a push into private-brand marketing:

They rapidly are buying or building high-volume super-stations and selling unadvertised brands of gasoline at 2 cents under their major-brand price.

In some places majors are competing with themselves and helping undermine the major-brand price structure.

The justification: They have control of the outlets and won't let their own price cutting get out of hand.

High-volume stations on main highways give little service, need less margin than major-type stations, and appeal only to price-conscious transients and others without any brand loyalty.

The big question: Will these private-brand outlets eventually be converted to major-brand stations and the price differential eliminated?

The whole industry is watching two or three big majors for a tip off on future policy.

▼ ▼ ▼

Large number of independent marketers selling to majors in recent months doesn't mean independents generally are in dire shape or will be eliminated from the industry.

Majors in most instances have had to pay very handsome prices for the outlets. Distress selling is rare.

Usual reason for selling out: Owner has plowed back a life time of earnings into building up business. He has no sons to carry on. Family faces inheritance-tax problems and sale is chance to cash in on capital gains.

Often, too, the little business needs more capital for expansion than the owner cares to invest or borrow.

A suggestion to cure the surplus of service stations: Abandon the submarginal outlets and concentrate on the good ones.

Some marketing executives are coming around to this view. They say the reason losing stations stay open is the refusal of marketers to admit mistakes the way producers do.

When a producer drills a dry hole, he plugs it, shrugs and walks away. Marketers could learn a lesson from that.

Bitterness is growing among importers over premiums they must pay inland refiners for trading off crude quotas.

Premium is now roughly $1 per barrel.

Importers view this essentially as a tariff for the privilege of importing. They would rather pay it into the government till than to their competitors.

Some ask privately: When will the smart boys in Washington wake up to this loss and decide to route this buck a barrel into the public till?

Most importers think the present allocation system is unconstitutional but want someone else to test it in court.

Government is stepping up its charter of commercial tankers so it can mothball ones in the Military Sea Transportation Service fleet.

Latest such deal involves charter of five commercial tankers, with six government-owned T-2 tankers to be withdrawn from service.

▼ ▼ ▼

Area-ceiling formula for regulating producers' gas prices is subject of quiet experiment by FPC.

Line on FPC's idea of proper ceiling for any area usually can be guessed by analysis of rates it has approved.

Tip: Producer often may get a price increase approved without hearing or investigation if he stays within ceiling.

Chances are even better if the increase is not large, if it will not trigger favored-nation contracts of others, and if producer gives some reasons such as increasing volume of gas, extending life of contract, or dropping indefinite escalation provisions.

Commissioner Connole frequently dissents on ground that FPC must have some evidence for finding that price increase is just and reasonable in order to make an appeal-proof case. Many lawyers think Connole is right. They say that condition can be satisfied by sketchy evidence of producing costs.

Greatest obstacle to finding a practical way to regulate gas prices is the public utility commissions of eastern consuming states.

Many gas executives report the commissions have political power to block remedial legislation. They also increasingly use obstructionist tactics to delay FPC action.

By insisting on strict and detailed cost formulas for every producer, these state officials stymie FPC efforts to take shortcuts and reduce the backlog of pending rate cases.

▼ ▼ ▼

Pipeline people can expect little impact to follow Atty. Gen. Rogers' tart remarks in his report on Interstate Oil Compact Commission.

Report claims cooperative use of pipelines by majors

holds grave potential for control of crude-oil markets. But the report held nothing new. It cited no illegal actions, didn't contend pipeline growth has failed to keep pace with expanding needs (p. 58).*

Only one hurdle remains to merger of Pacific Northwest Pipeline and El Paso Natural Gas.

That is disposition of an antimerger suit filed by the Department of Justice. A Utah federal judge has delayed action on the case.

Another hurdle was cleared last week when the FPC gave its approval to the merger. FPC ruled it was in the public interest from standpoint of improved gas supply, use of gas reserves, and service to customers (p. 51).

Tennessee Gas has filed application with FPC for permit to import Canadian gas into the U. S. near Niagara, N.Y.

TGT proposes to purchase from Trans-Canada, on an interruptible basis, up to 200,000 M.c.f. daily. It would use facilities previously built for moving U. S. gas to Canada.

▼ ▼ ▼

Crude prices have firmed in California.

Union Oil raised its postings by 5 to 25 cents a barrel to get its prices in line with postings of other majors.

Union touched off a crude-price decline last September with a 10-to-50-cent cut. General Petroleum met the cut but California Standard went only half way with a 5-25-cent drop. General Petroleum later moved up to the Standard price. Union waited until last week to complete the stabilization.

What compact cars mean to oil is becoming clearer:

...Fuel consumption in 1960 for passenger cars will be 2% below what it would have been if all cars were standard.

...Regular-grade gasoline will fuel about 72% of 1960 passenger cars with premium serving 28%. This will free refiners from pressure to turn out higher octanes and put the spotlight on a better-grade regular.

Sales of compact and foreign cars will account for 25% of new-car sales in 1960 and will represent 6% of all cars on the road (p. 46).

▼ ▼ ▼

New drilling system is being tested by Houston firm.

Strato-Drilling, Inc. is making hole with a technique which:

...Uses reverse circulation to reduce volume of mud.

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*Refers to article in this issue giving more details. Where no page is given, the item is a Newsletter exclusive.

...Pumps through concentric drill string to keep pump pressure off the formation.

...Uses core bits only, circulating the core to surface continuously as drilling progresses.

...Rotates with power swivel so that bit doesn't have to be lifted from bottom to make connections.

Possible advantages: Cuts down on round trips, can operate on low horsepower pumps, cuts rig costs and mud expense, drills deeper with air, gives continuous core (p. 48).

Largest single drilling contract ever negotiated will be launched this week by a Dallas contractor in Argentina.

Southeastern Drilling rigs will start making hole in Comodore Rivadavia on a program to drill 1,000 wells within next 4 years.

At peak of work, 16 rigs will be busy completing 300 wells a year (p. 61).

▼ ▼ ▼

New oil hunting tool will be produced soon by California Standard and Borg-Warner.

It's called a nuclear magnetism log. It accurately seeks out petroleum and natural-gas deposits by measuring magnetic variations of their atomic particles.

The log is housed in a tubular casing and is lowered into the well on a cable wire. California Standard experts say the log is more precise than previous instruments.

Geologists are having a family squabble over one big question: Will registration laws give them new status or help cure ills of the profession (p. 52).

Advocates of strict licensing see these advantages: Profession can police its members better and establish higher academic standards or experience requirements.

Opponents, however, contend registration would be step toward socialization, government control, and would not rid the profession of phonies.

▼ ▼ ▼

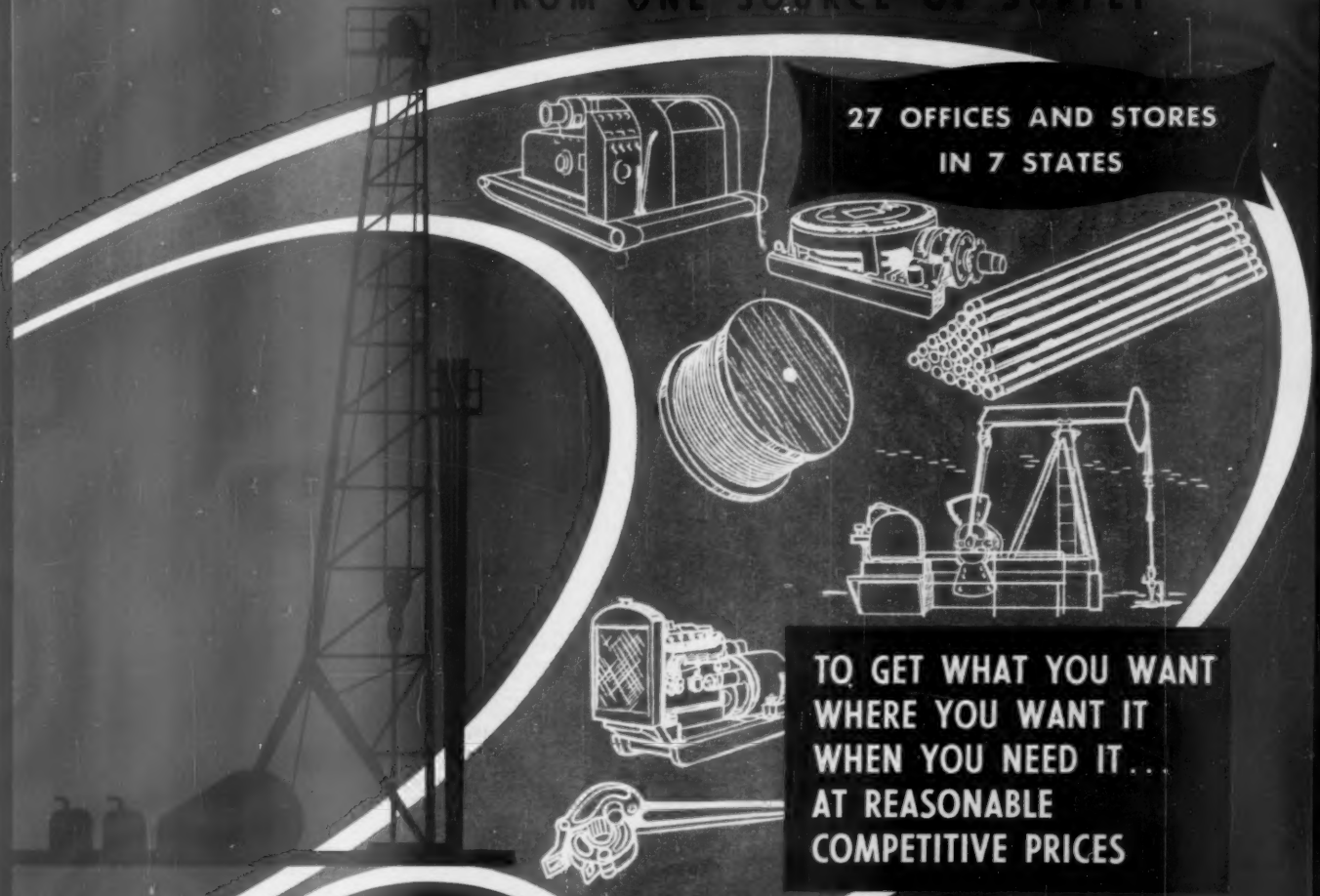
Scientists and engineers in industry are not happy with their lot, a new survey reveals.

Fundamental trouble: Conflict between management need to sell and make a profit and the quest for knowledge by the technical man.

The study shows that of 727 scientists, engineers, and managers of firms engaged in research, 72% complained their talents were misused; 71% said they were forced to overspecialize; 67% said getting ahead was matter of politics not knowledge; 80% said they were underpaid compared with others of similar training and responsibilities.

Everything You Need

FROM ONE SOURCE OF SUPPLY



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WHERE YOU WANT IT
WHEN YOU NEED IT...
AT REASONABLE
COMPETITIVE PRICES

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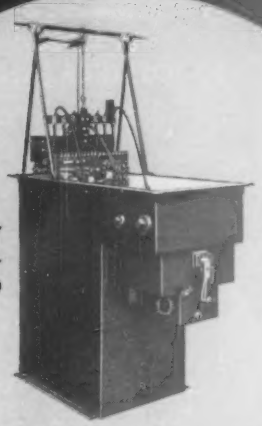
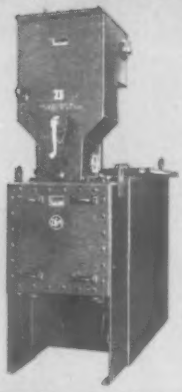
TOTALLY OIL-IMMERSED



Type AT Combination Starter shown with Contactor and Overload Panel raised above the oil level without disconnecting any bolts or leads—in NEMA 3R enclosure for outdoor mounting, available in 50,000 KVA (certified) interrupting capacity.

OIL-IMMERSED

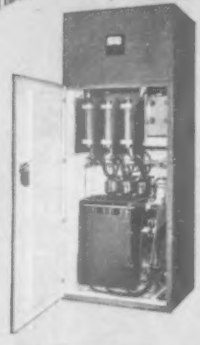


Type AM Combination Starter in NEMA 3R enclosure for indoor or outdoor locations—available in 50,000 KVA (certified) interrupting capacity —and VALIMITOR.®

OIL-BREAK

Type AH Combination Starter in NEMA 1 or 3R enclosures for indoor, outdoor or pressurized control room—available in 3 interrupting ratings, 50,000 KVA—POWER FUSED—and VALIMITOR.®

AIR-BREAK



Type AFG Combination Starter for Pressurized Control Rooms. Built in Class E1, Class E2 and VALIMITOR.®

For complete information write for Bulletin 8131-L

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MATCHLESS #5 STEAM HOSE

3 Men . . . 3 Applications
One Hose

Safety
U. S. Matchless #5 Steam Hose has been used at a Phillips Petroleum refinery* since 1930, for thawing and firefighting.

Easy Handling
Here U. S. Matchless #5 is being used to remove spilled oil.

Economy
Warehouse boss at Phillips Petroleum inspecting a length of U. S. Rubber Matchless #5 Steam Hose.

Men like to work with U. S. Matchless® #5 because it's so lightweight, so flexible. Ordinary hose is hard to handle, can't take much dragging around. But the hose that's readily available, lasts longer, and satisfies the operators is the best investment. That's U. S. Matchless.
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*Okmulgee, Okla.

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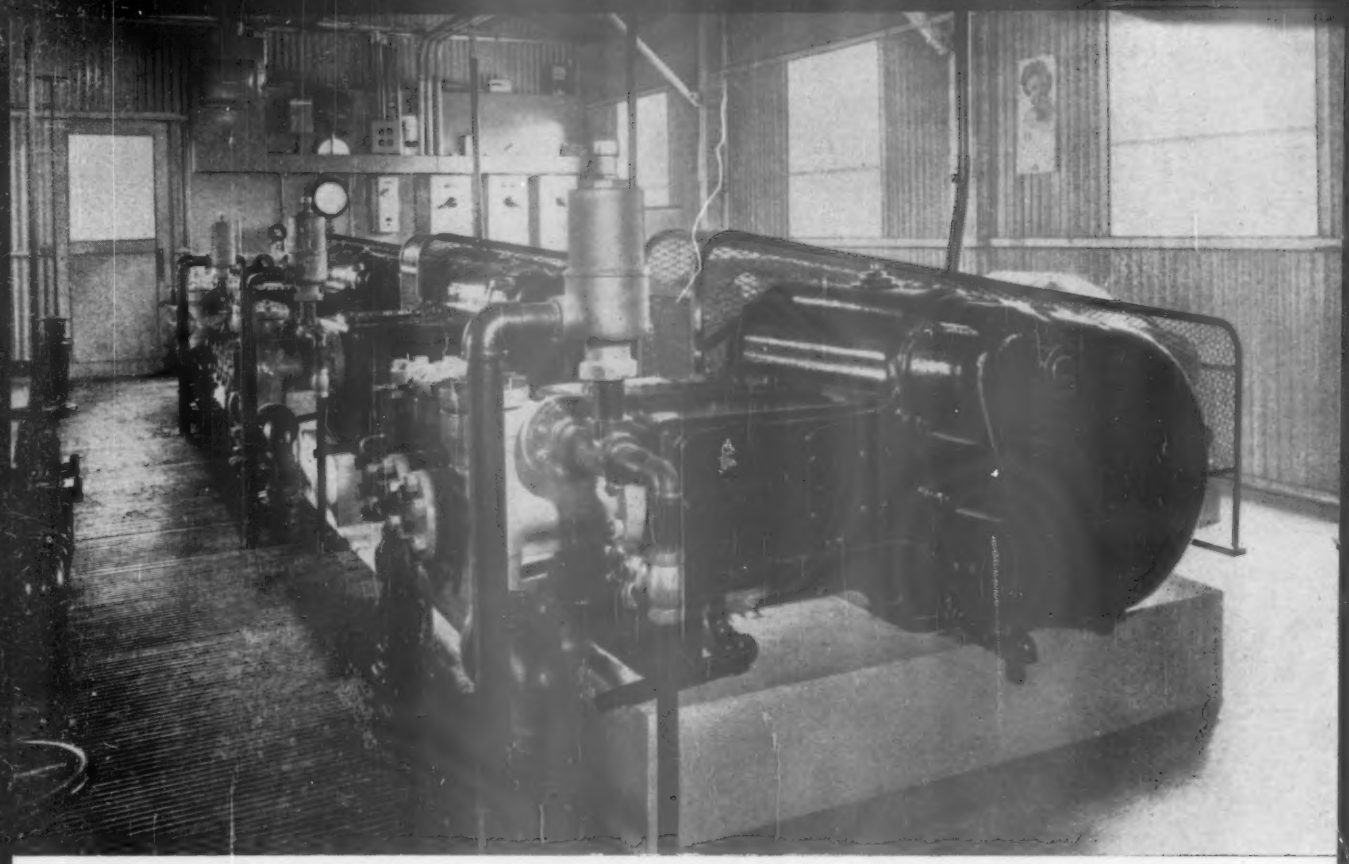

Five "Oilwell" 36-P Triplex Plunger Pumps operate this Lee County, Kentucky, waterflood. A first plant with two pumps was installed some two years ago. The second plant with three pumps (illustrated) was added the following year.

Take the risk out of "put and take" with "Oilwell" Pumps and Pumping Units

AN OIL producer in Kentucky has taken the chance out of these "put and take" operations by installing five "Oilwell" waterflood pumps to **put** water into the wells and 125 "Oilwell" medium-duty pumping units to **take** oil out.

All these units are designed for continuous, rigorous operation with a minimum of attention. Both pumps and pumping units incorporate money- and maintenance-saving features.

An important benefit that this operator will enjoy is dependable service from a single source . . . the local Oil Well Supply Store. Maintenance parts and supplies will always be of the same high quality as originally furnished with this equipment. And "Oilwell" specialists will always be available when needed for consultation on any production problems which may arise.

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This installation is typical of the electric-powered "Oilwell" 25L3 Pumping Units which are used to take out the oil.

IH Bullgrader is raised, lowered, angled, and tilted hydraulically from the tractor seat.

Dig 10 feet deep with rugged, low-cost International Wagner No. 65-T backhoe. Digs anywhere in 180° arc.

Backfill, dig, load with low-cost, sturdy International Wagner No. 465 loader, capacity 3,500 lb.

Exclusive International Drott 4-in-1 combines ¾-cu yd bucket, bulldozer, carry-scraper, and clamshell.

Only the price is small!

The busy new International® T-340 helps you keep your work on schedule

Now you can have International crawler tractor traction, flotation, and dependability in a new economy size. It's the International T-340, scaled and equipped for a wide range of miscellaneous utility jobs.

Delivering 45 hp*, the husky, trigger-quick, four-cylinder engine gives you top operating economy in its power class. Optional Torque Amplifier drive gives you 10 speeds forward . . . plus a 45% pull-power boost in any gear *on-the-go*, at a touch of the TA lever. Or for shuttle-type jobs, choose Fast-Reverser which gives five speeds coming *and* going.

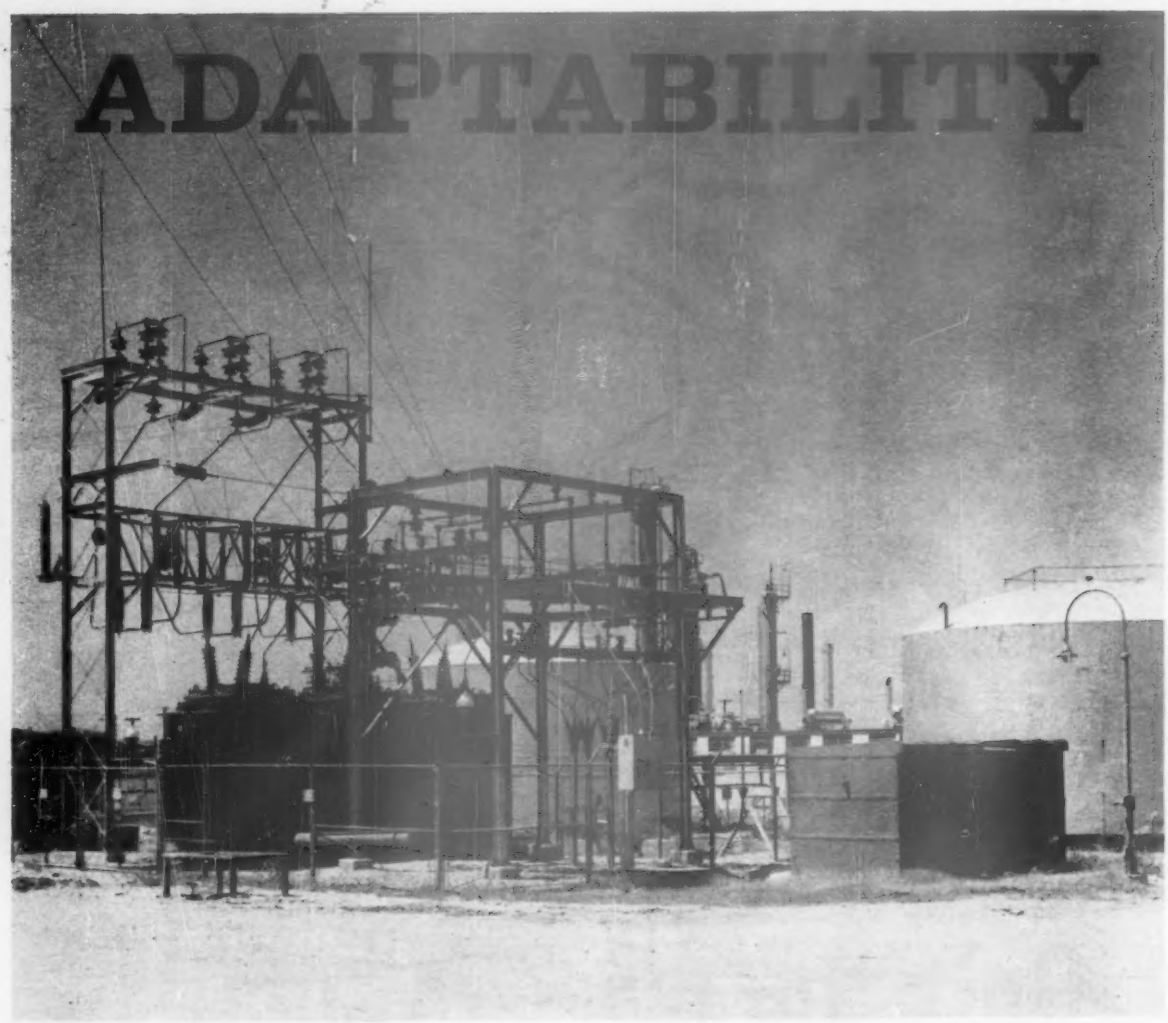
Unit-engineered equipment makes full use of the T-340's power, speeds, and ruggedness to get your work done fast and efficiently. Ask your IH dealer to demonstrate the "terrific" T-340 with the matched equipment to fit your kinds of jobs.

**Maximum flywheel horsepower at standard sea level conditions.*

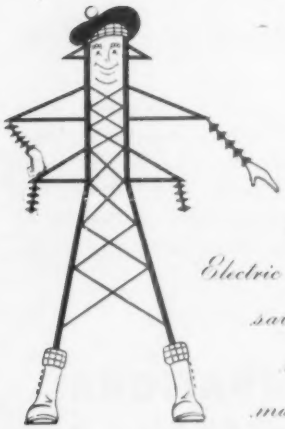
See your INTERNATIONAL HARVESTER dealer

International Harvester Products ***pay for themselves in use*** **—Farm Tractors and Equipment . . . Twine . . . Industrial Tractors . . . Motor Trucks . . . Construction Equipment—General Office, Chicago 1, Illinois.**

You can depend on purchased electric power for



This mainline crude oil station was converted to purchased electric power.



Purchased Electric Power . . . saves money, manpower, maintenance, and serves you better automatically

Typical of money saving installations is this new crude station using utility electric power

This modern station using three 500 hp and two 150 hp motors and 22 electrically operated valves is evidence of the trend to purchased electric power for ultimate economy. Whether your operation is pipeline, refinery or production it will pay you to investigate the possible savings of utility electric power. Call your nearest utility electric power company today.

Petroleum Electric Power Association P.O. BOX 35006, DALLAS 35, TEXAS

Another new development using

B.F.Goodrich Chemical *raw materials*

160-ton concrete roadway sections cast by Prestressed Concrete Products Co., Inc., Mandeville, La., are barged to Pensacola, Florida, and lifted onto piers of this new highway bridge.

2" vinyl conduit for bridge lighting and ¾" for navigation lights encased in concrete parapet, poured after bridge slabs are in place. Conduit is made by Dixie Plastics Mfg. Co., Division Marine Controls Laboratories of New Orleans. B.F.Goodrich Chemical Company supplies Geon vinyls.

40,000 feet of conduit made of Geon vinyl matches permanence of concrete structure

Electrical conduit made of Geon rigid vinyl will be encased in concrete to become a permanent part of this new 3-mile bridge. It's permanent because Geon vinyls resist the moist, salt atmosphere; corrosion won't shorten life or cause clogging of the conduit.

A unique, sealed slip joint, also made of Geon vinyl, in each conduit line is inserted between every concrete section. This allows for expansion and contraction of the bridge, while maintaining a watertight seal in the conduit.

Rigid vinyl conduit and pipe made from Geon is lightweight and easy to install. Being a non-conductor, vinyl is not affected by ground currents. It has high tensile and impact strength, and it resists fungi, bacteria, heat and cold. To learn more about these and other products made from Geon vinyls, write Dept. GR-1, B.F.Goodrich Chemical Company, 3135 Euclid Ave., Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

Geon VINYLS

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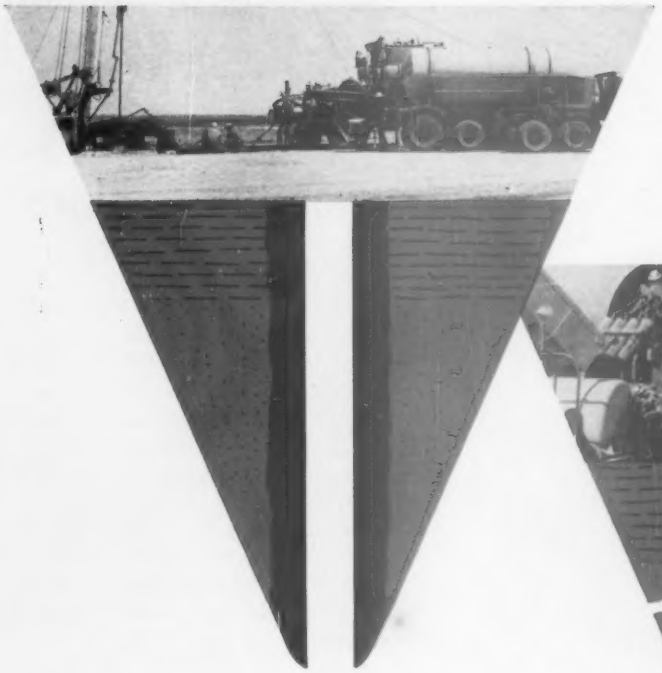
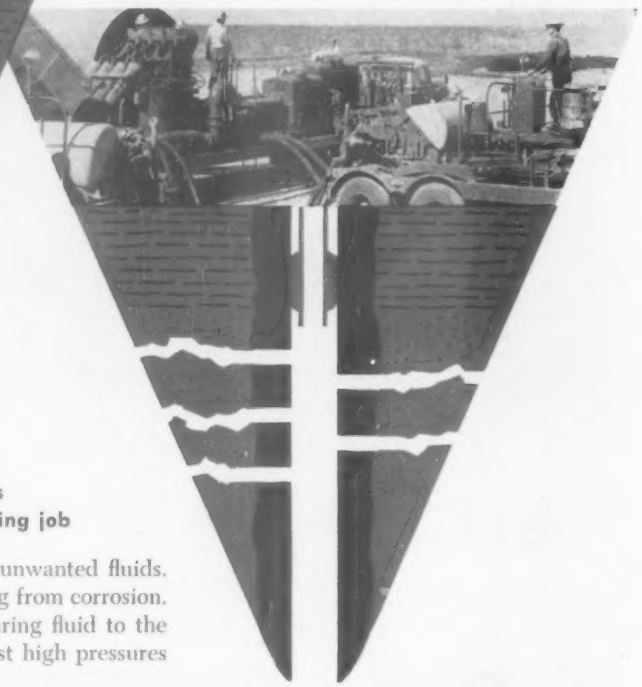
pave the way to better fracturing



Good cementing
and good fracturing
go hand in hand



A good primary cementing job is the basis for a good fracturing job

It isolates the producing zones from water and unwanted fluids. It seals off high-pressure gas zones. It protects casing from corrosion. By isolating the producing zone, it confines fracturing fluid to the desired formation. It helps to protect casing against high pressures applied during fracturing operations.

A Halliburton cementing job gives greater assurance that your well will get the effective cementing it needs to prepare it for effective fracturing. And for protection of oil throughout its lifetime of production.

The time to start thinking about fracturing is before the primary cementing job. And the company to call for cementing is Halliburton.

284 SERVICE CENTERS...JUST MINUTES AWAY FROM YOUR WELL

HALLIBURTON

OIL WELL CEMENTING COMPANY

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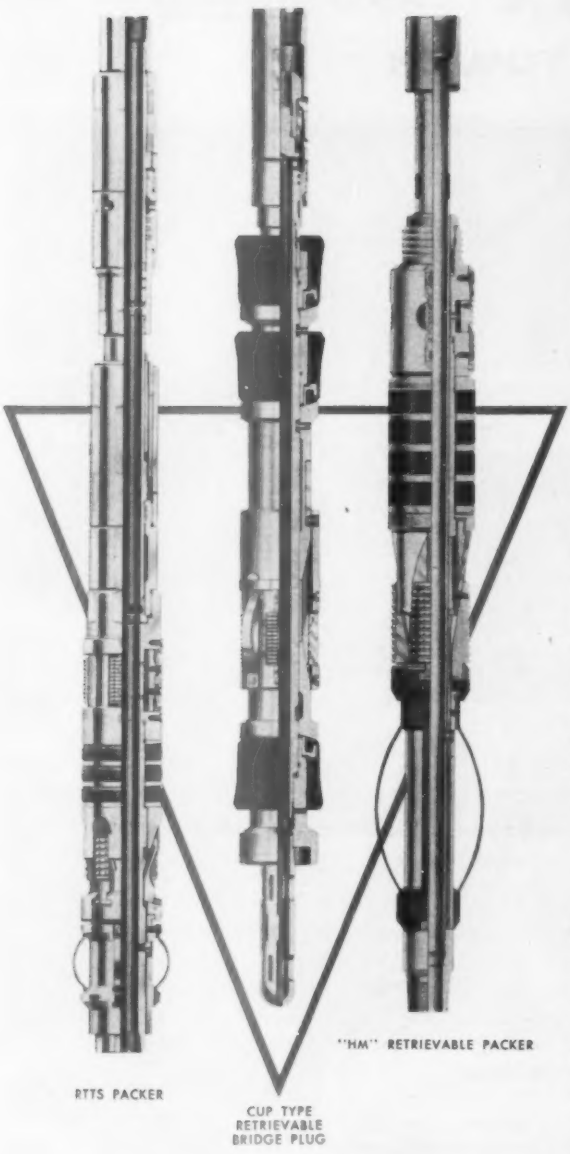
HALLIBURTON PACKERS . . .
Utility-designed for better fracturing



HALLIBURTON RTTS PACKER (Retrievable-Test-Treat-Squeeze Packer)... multi-purpose hook wall type retrievable packer with a full-opening mandrel, designed for use in fracturing, as well as testing, chemical treating, and squeezing operations.

Hydraulic hold down with large slips built into the tool above the packer rubbers. Slips engage the casing only when pressure is applied through the tubing to the area below the packer to prevent any upward movement of the packer due to force created by the pressure under the packer. Full-opening mandrel permits the pumping of large volumes of fluid with minimum pressure drop, also allows passage of tubing-type perforating gun. Operated by simple tubing manipulation.

HALLIBURTON CUP TYPE RETRIEVABLE BRIDGE PLUG . . . is especially suited for fracturing operations. It provides a pressure seal from both directions and can be used for swab testing a zone before and after a treating operation. Used alone or below an RTTS tool, the Bridge Plug can be set repeatedly and retrieved with only one trip in the hole. Overshot with washing skirt permits washing sand from top of tool when retrieving.

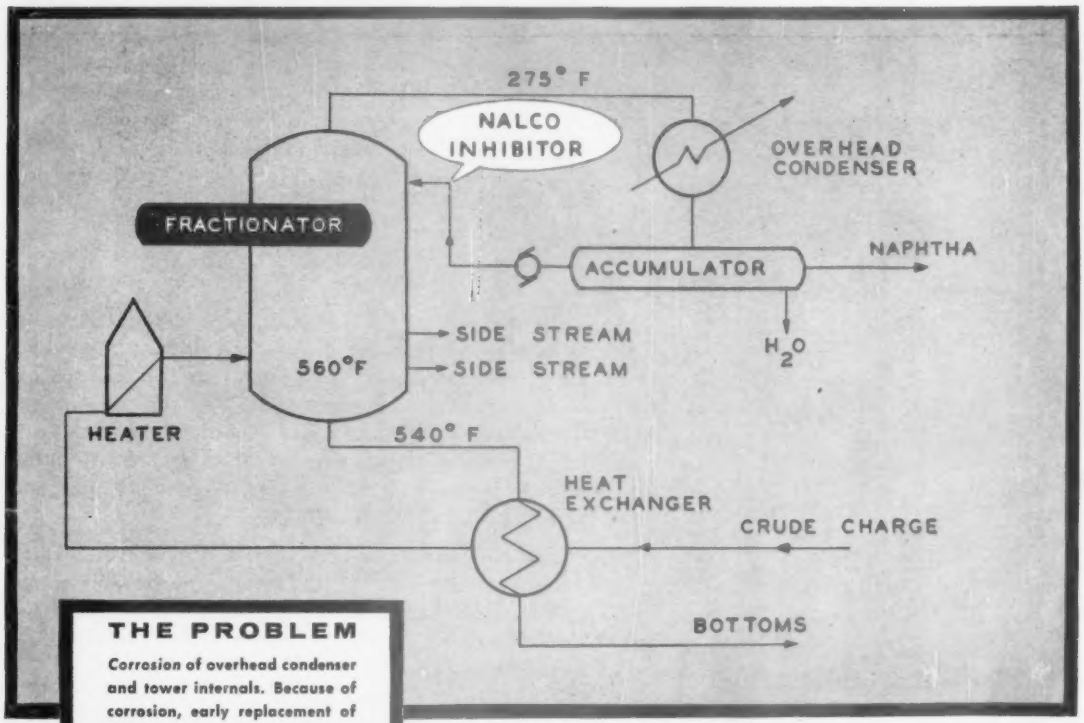
The tool consists of cup type sealing elements which are self-sealing with application of pressure differential, and double-acting hook wall type slips with a dual wedge arrangement for positive anchoring against pressure from either direction.

HALLIBURTON HM (Hydro-Mechanical) RETRIEVABLE PACKER... full-opening hook wall type packer designed to be run in cased hole on tubing to isolate a section to be fractured, acidized or tested.

Hydraulic slips engage casing only when pressure is applied through tubing to area below packer. These slips prevent the packer being moved up the hole by high injection pressure applied below the packer. Full-opening mandrel permits pumping a high volume of fluid with minimum pressure drop. May be set as many times as desired without coming out of hole.

CEMENTING SERVICES · FRACTURING SERVICES

HOW *Nalco* INHIBITORS CUT DOWNTIME 74% ...AND SAVED THIS FRACTIONATING TOWER



THE PROBLEM

Corrosion of overhead condenser and tower internals. Because of corrosion, early replacement of the tower was contemplated.

THE TREATMENT

Nalco Corrosion and Fouling Inhibitor applied into overhead reflux.

THE RESULT

In this case only one point of application protected both fractionator and overhead equipment. Iron in accumulator water brought below 0.5 ppm as compared to previous 100-150 ppm. Corrosion and plugging stopped, tower saved, and downtime for cleaning reduced by 74%.

EFFECTIVE Nalco corrosion control is very low-cost protection. For example, this refinery not only avoided the cost of a new tower, but cleaner tower internals actually resulted in better fractionation and higher quality products. If you would like further facts on Nalco Corrosion and Fouling Inhibitors, ask your Nalco Representative or write direct.

National Aluminate Corporation is now

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THE *Nalco* ® SYSTEM ...SERVING INDUSTRY THROUGH PRACTICAL APPLIED SCIENCE

Nalco CHEMICALS

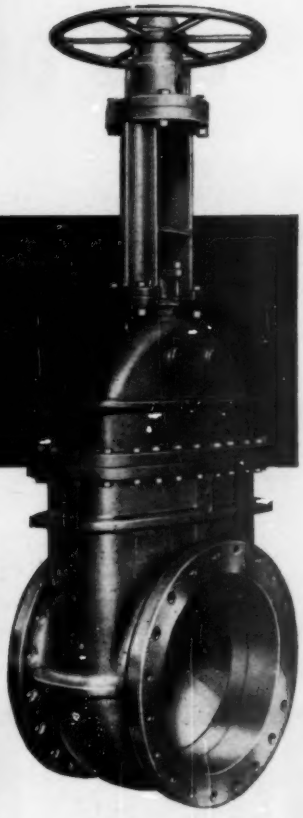
Check this DARLING gate valve trio for

UNMATCHED ADVANTAGES

in every oil, gas and petrochemical service

DARLING FULLY REVOLVING DOUBLE DISC GATE VALVES

—famous for *consistently* trouble-free operation in all kinds of service. Revolving disc principle assures easy operation, surer closure, minimum friction, automatic seating compensation, extreme life with minimum maintenance. Ask for Catalog 57.



DARLING ALUMINUM ALLOY GATE VALVES

—featuring all the advantages of the above revolving disc principle, *plus* new economies in the handling of "problem" fluids and gases or wherever aluminum piping is used. Ask for Bulletin SLS 5801.

DARLING-McEVOY SELF-SEALING CONDUIT VALVES

—the *only* conduit gate valve with *sealant gasketing* between gates and seats. Every closure leakproof! This and other advantages proved by outstanding performance on major lines. Get *all* the facts. Ask for Catalog 57.

Whatever the service, in any phase of pipelining, gathering or processing, these Darling gate valves offer worthwhile features and advantages unobtainable in other valves. The catalogs referred to above are available to give you the pertinent facts.

DARLING VALVE & MANUFACTURING CO.

Williamsport 1, Pennsylvania

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.

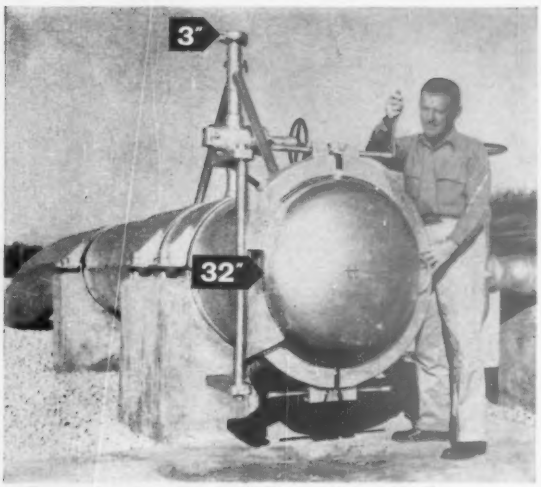
DARLING

DARLING

VALVES

NEW...FROM TUBE

an improved hinged closure for pipe lines, piping and process equipment



One man, using any standard wrench, can easily open or close the TUBE-TURN *Hinged Closure. Has important safety features, too!*

Tube Turns announces a new line of hinged closures with important advantages for pipe lines, piping and process equipment wherever frequent access is required or where the use of blind flanges would be cumbersome and time consuming. Proved in scores of applications by major companies, the unique TUBE-TURN* Hinged Closure provides these benefits:

Saves installation time. Light weight assembly easier to handle. Completely fabricated . . . ready to install. Requires only one butt-weld to join to pipe, tank or vessel opening.

Saves operating cost. One man, using a standard wrench, can easily open or close the largest size closure in a few minutes. No threads or lugs to engage or flanges to line up. No parts to fail. No hammering or tugging. Can be adapted to motorized operation. Closures for vertical applications can have counterbalanced caps for easy operation.

Saves on maintenance. Oil resistant, self-energizing static "O" ring provides seal. Does not move when cover is opened or closed. No rubbing or chafing to shorten seal life.

Built-in safety. Exclusive design features of two-piece yoke, double-ended right- and left-hand threaded bolts and hinged cap guard against accidental opening under pressure.

These new TUBE-TURN Hinged Closures provide still another *plus value* you can get when you specify TUBE-TURN products and buy them from your nearby Tube Turns' Distributor. They are available in sizes 2" through 42" for A.S.A. 150-lb, 300-lb and 600-lb service . . . in steel or alloys.

*"TUBE-TURN" and "tt" are trademarks of Tube Turns.

For vertical applications, TUBE-TURN *Hinged Closures can be equipped with spring-loaded, counterbalanced caps.*

TURNS...

Another tt *plus value from...*

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FREE BULLETIN . . . Complete information on the new line of TUBE-TURN Hinged Closures will be sent on request. Mail coupon.

TUBE TURNS, Dept. OG-1
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Please send Bulletin TT956 on new TUBE-TURN Hinged Closures.

Company Name _____

Company Address _____

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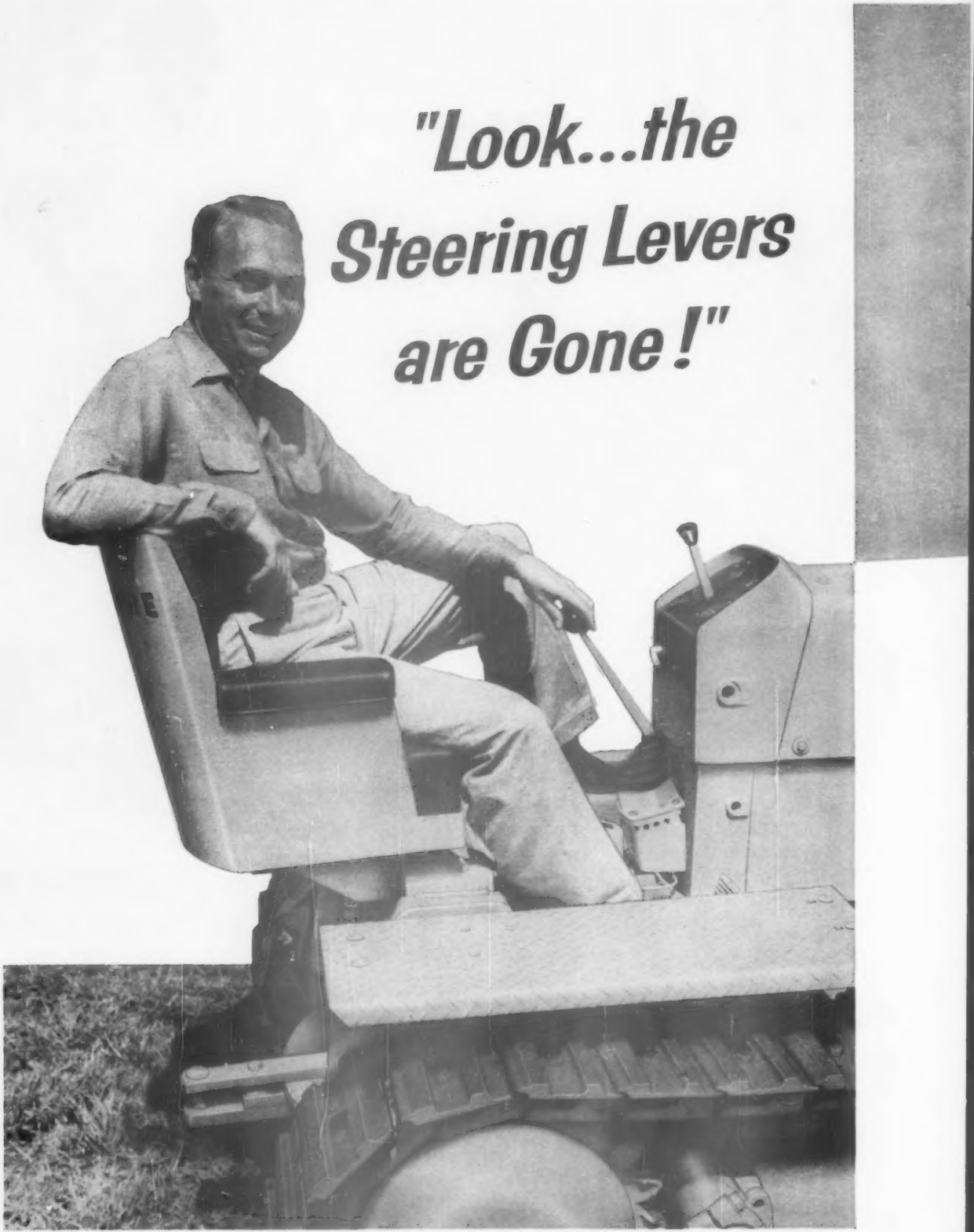
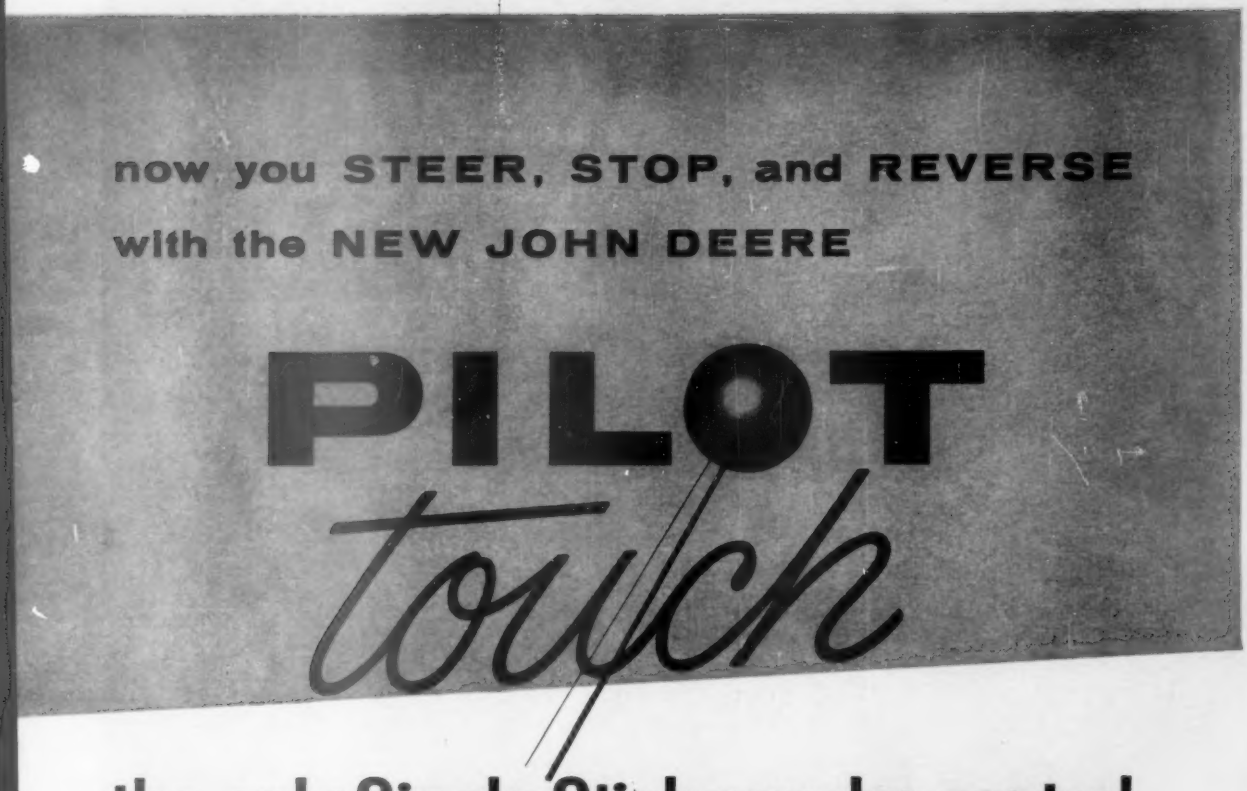

"Look...the
Steering Levers
are Gone!"



the only Single Stick crawler control

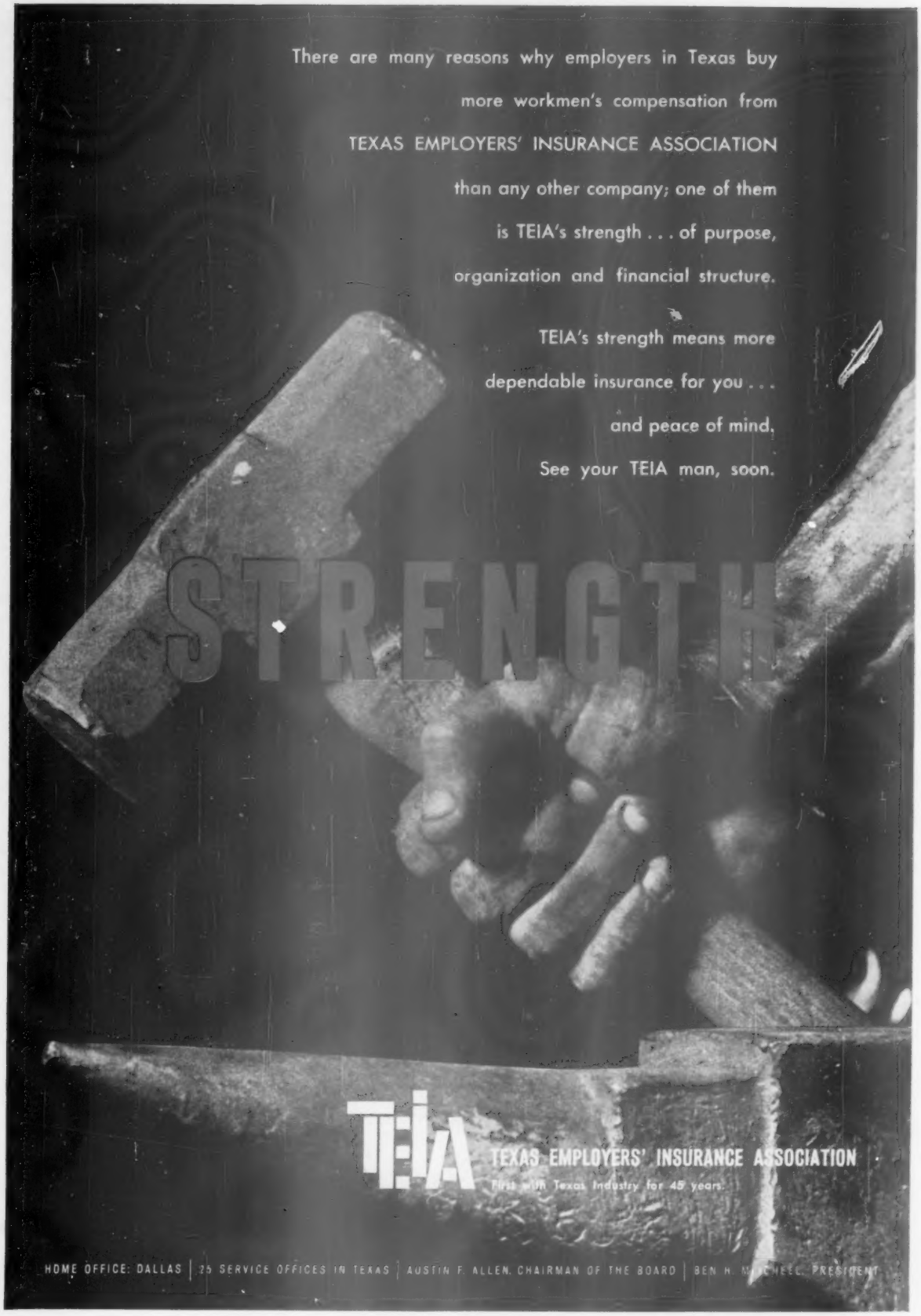
Ease the stick forward, back, left or right—the way you want to go—and the John Deere Crawler obeys! Clutching is automatic—braking, too—so no footwork is required.

One-hand driving with hydraulic-powered Pilot-Touch keeps the operator fresh and alert—frees a hand for full-time control of loader, dozer, or other equipment. Payoff—a better job, and higher daily work production.

Pilot-Touch is an exclusive John Deere development, yours optionally on both Diesel and gasoline "440" crawlers. Your nearby John Deere Industrial Dealer soon will be demonstrating crawlers with this new hydraulic-powered control. See him or write us for complete details.

John Deere Industrial Division, Dept. 2045, Moline, Ill.

JOHN DEERE *"Specialists in Low-Cost Power with a Heavyweight Punch"*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DU PONT Petroleum Chemicals NEWS

Number 100 in a Series of Bulletins for the Petroleum Industry

JANUARY-FEBRUARY 1960

WHAT'S NEW IN DYES?

Du Pont Improved Free-Flowing flaked dyes provide many advantages

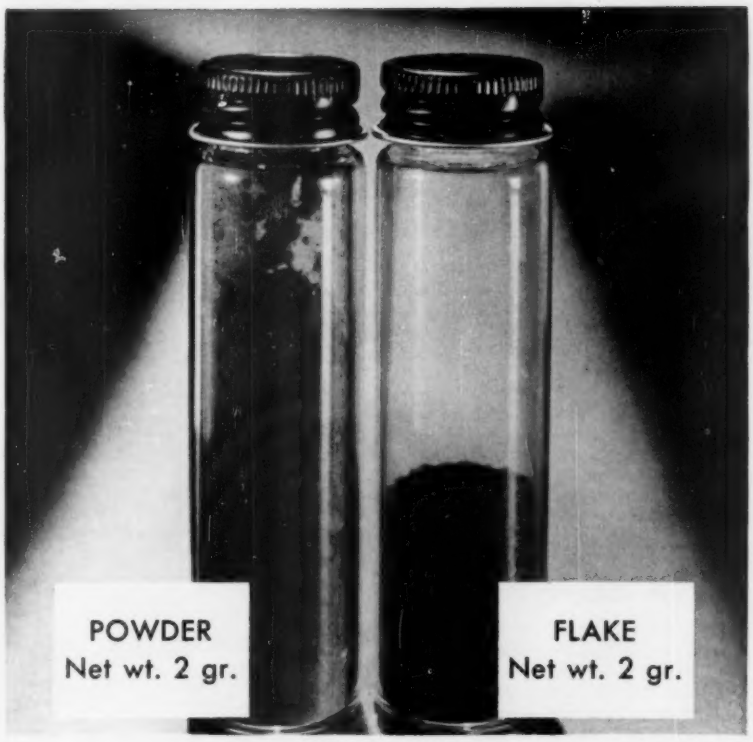
ADDITIVES MANAGER

W. E. BETTONEY is now serving as Manager of Additives. In this capacity he is responsible for the sale and technical services for all Du Pont additives other than tetraethyl lead.

Prior to this appointment, Mr. Bettoney served as Technical Manager for the Eastern Region. And before being named to that post, he was assistant director of the Du Pont Petroleum Laboratory.

Mr. Bettoney joined Du Pont in 1946 as an engineer in the Petroleum Laboratory. For several years he was associated with application research on the effects of chemicals on the performance of petroleum products in engines.

Mr. Bettoney is a mechanical engineering graduate of the University of Maine. Before joining Du Pont he was with the Dodge Division of the Chrysler Corporation in Chicago. Mr. Bettoney is a member of the S. A. E. and A. C. S.



Du Pont Oil Colors in flaked form occupy less space.

Du Pont oil colors have been available in either powder or flaked form for some time. Because flaked dyes are virtually dust-free, they have been constantly gaining in popularity. The newest Du Pont flaked dyes are now further improved so that they dissolve more readily than ever. As a result, more and more refiners will find that Du Pont's fast-flowing, fast-dissolving, dust-free flaked dyes are more satisfactory than ever.

Less bulk The flaked form of Du Pont Petroleum dyes takes up approximately half the space of the same dye in conventional, powdered form, thus saving refiners valuable storage space. Furthermore, flaked dyes come in short drums (22 inches high) which are easily handled.

Many colors You can get Du Pont flaked dyes in orange, red and bronze. Blue dye is available in a crystalline form which has the same advantages as flaked dyes. Samples and full details are available now from your Du Pont Petroleum Chemicals representative.

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

DU PONT *Petroleum Chemicals* NEWS

New instrument for studying surface ignition

Engineers at Du Pont's Petroleum Laboratory have announced the development of a new electronic instrument for investigating surface ignition.

Used in any car

This instrument will help provide clues to both better fuels and improved high-compression power plants, since it is now possible to study surface ignition in any automobile by merely installing special pressure-sensing spark plugs in the car's engine. Surgery to the engine is eliminated.

Using a double-tracked recording tape, the new instrument determines the exact time in the cycle when the combustion pressure reaches its peak. Such information is developed for each cylinder.

Transducer at work

Heart of the electronic instrument is a special normal-sized spark plug equipped with a built-in miniature piezoelectric pressure transducer. These plugs can be substituted for standard plugs in most cars.

Variability of the instrument is less than plus or minus one-tenth of a crank-angle degree, or about five millionths of a second at 3200 engine revolutions per minute.

If you would like to know more about the instrumentation and what's been learned through it, write for a copy of "Surface Ignition—A New Look with a New Instrument."

How to keep copper from making trouble

Copper-bearing surfaces can exert a harmful pro-oxidant effect on petroleum products. In helping overcome this, Du Pont Metal Deactivator chelates with copper ions and thus essentially removes them from the reaction.

Another Du Pont product, Du Pont Metal Suppressor, reduces the possibility of copper catalyzed reactions by forming a film on the copper surface which insulates the metal from the petroleum product. Thus, copper strips which have been exposed to Du Pont Metal Suppressor are passive for some time after—even when contacted by products that do not contain the compound. Du Pont Metal Suppressor also works on brass and monel.

CONTINUED *What's new in dyes?*

Du Pont Oil Red A is announced

The most recent addition to the line of Du Pont dyes made expressly for the petroleum industry is Du Pont Oil Red A.

This is an oil-soluble dye for use with gasoline and other petroleum products. It imparts a slightly different shade to gasoline which is generally considered to be 10 to 25 per cent stronger, depending on test procedure used, than conventional reds, such as Du Pont Oil Red.

Two forms Standard packages contain 100 lbs. net. You can get Du Pont Oil Red A in powdered form, shipped in non-returnable 41-gallon fiber drums. Flaked Oil Red A comes in the 24-gallon drum.

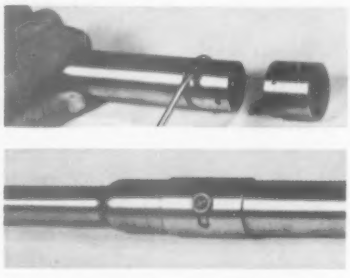
For more information, contact the office nearest you. Please see the listing below.

Modified Du Pont Dry-Dye Eduction probe offers many advantages

Until a few years ago, the dry-eduction method of handling dyes was little used. Equipment was not very efficient. Clogging, as well as other difficulties, was an ever-present problem.

Then in 1956, Du Pont introduced the "tube-within-a-tube" design. So successful was this probe that it soon became the most popular dye-handling tool in the industry.

New brass tip Now, after several years of experience, further refinements in the Du Pont design have been made. For example, brass is now used in the tip for increased durability. And the tip can be easily removed merely by flexing the securing clip with a screwdriver.



Improved air inlet The other major change is an improved air inlet which provides for a continuous flow of air as well as for easy setting of the air port to fit individual needs.

This model probe is known as No. WT-503 Du Pont Dye Probe. Your local Du Pont representative can fill you in on availability as well as discuss the possibility of modifying the earlier model with new parts.

Or write for the just-printed Additives Handling Bulletin No. 5.

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In Canada—Du Pont of Canada Limited, Petroleum Chemicals, 85 Eglinton Ave. East,
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Du Pont Tetraethyl Lead and other Petroleum Additives

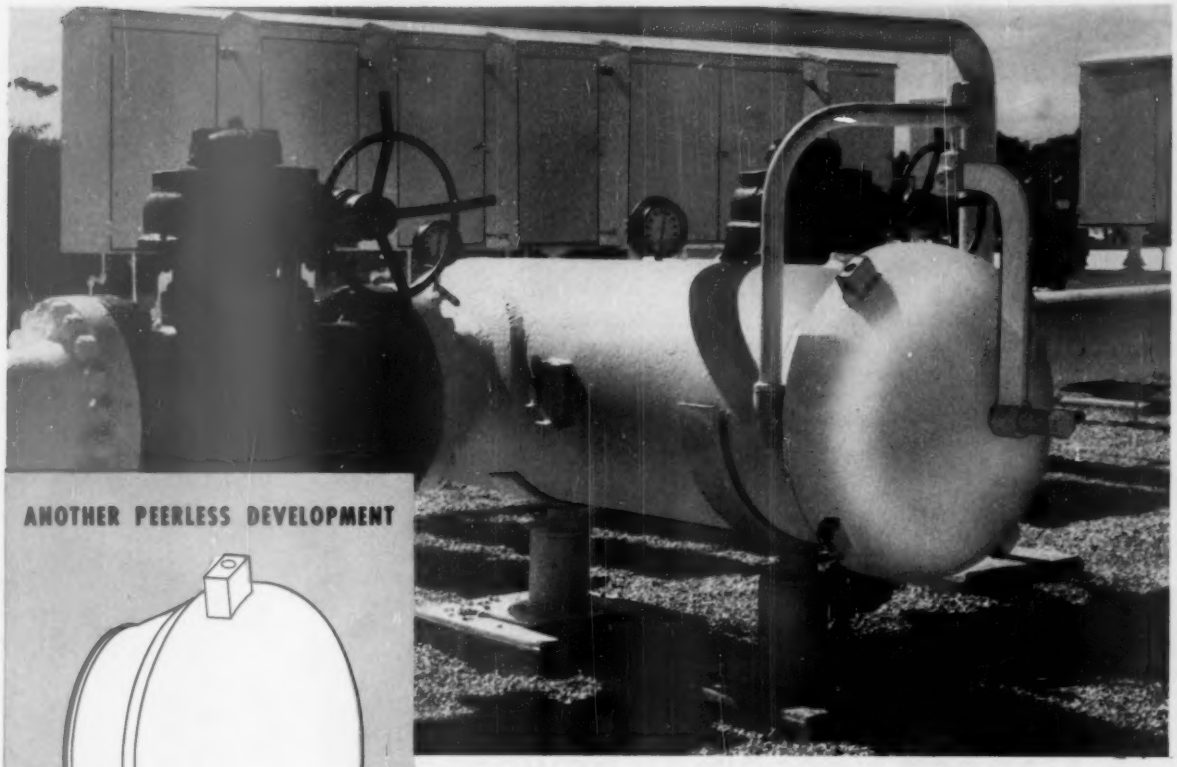
OVER

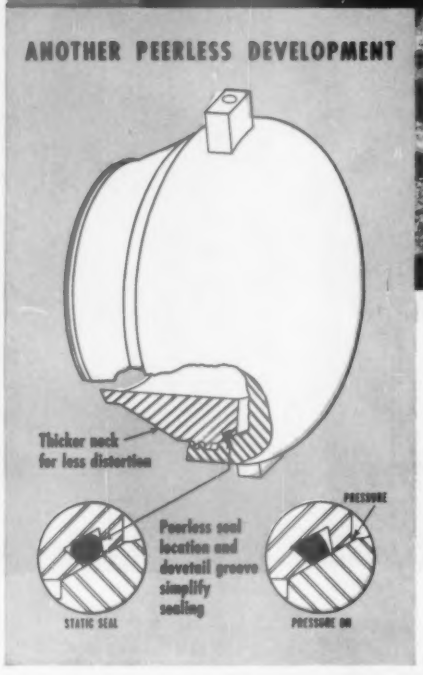
ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

A-12705

Printed in U.S.A.

New Peerless O-Ring Closure Design assures fast, tight seals at low cost





The Peerless O-Ring Closure includes exclusive design features that field experience has shown are essential to easy dependable operation.

1. The cap is a weld cap which eliminates the usual casting and makes possible lower initial cost.
2. Tapered seating surface speeds assembly.
3. Dove-tailed groove keeps O-Ring in place if swollen.
4. Outside position of seal ring reduces possibility of sealing surface damage.
5. Heavy cross section of weld neck prevents destruction.
6. Hinges are factory installed.

Write for Bulletin today!

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PEERLESS MFG. CO.

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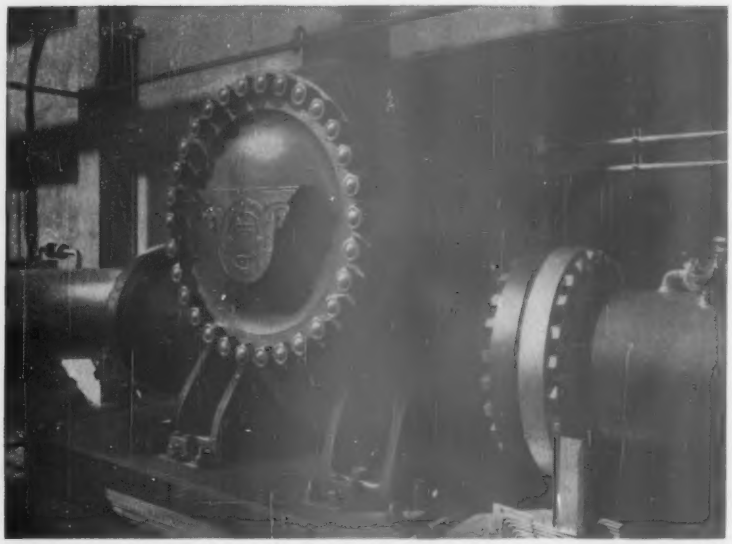

Cooper-Bessemer RFB-24 centrifugals, like this one, powered by Cooper-Bessemer LSV turbocharged gas engines, comprise the world's most efficient pipeline compressor units.

David M. Salls, *Manager, Gas Industry Sales, The Cooper-Bessemer Corporation, explains...*

How 5 Cooper-Bessemer powered, Gulf Interstate engineered stations will give Transwestern peak economy and flexibility

ALL FIVE of the mainline compressor stations of the new Transwestern Pipeline system will be equipped with Cooper-Bessemer engine-driven centrifugal compressors and will be remotely operated. These new automatic, remote-controlled stations will provide unexcelled efficiency and flexibility... a fact proven by the highly successful performance record of this modern equipment in other mainline stations of the same basic design—over 130,000 horsepower to date in mainline service.

The giant Cooper-Bessemer LSV-16 turbocharged gas engines will be of the type shown here. They will drive Cooper-Bessemer RFB-24 centrifugal boosters through speed increasers. Each of the five stations will include two of these high-efficiency compressor units. These units have the highest thermal efficiency obtainable in the gas industry today. The map shows the location of the stations. All units will be automatically controlled from a central point.

We will gladly supply details on this Cooper-

Map shows location of Transwestern's mainline automatic, remote-controlled stations. Background shows type of Cooper-Bessemer LSV-16 turbocharged engines to be used on this new line.

Bessemer equipment, and assist in *your* compressor station plans.

BRANCH OFFICES: Grove City • New York • Washington Gloucester • Pittsburgh • Chicago • Minneapolis • St. Louis • Kansas City • Tulsa • New Orleans • Shreveport • Houston • Greggton Dallas • Odessa • Pampa • Casper • Seattle • San Francisco • Los Angeles

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COMPRESSORS: RECIPROCATING AND CENTRIFUGAL
ENGINE, TURBINE OR MOTOR DRIVEN

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President, Hamon Oil Company
Past Chairman of the Board
American Petroleum Institute, 1956-1957

"Valued Partners . . ."

"My business is drilling for oil and gas. If the wells are successful, I must produce them efficiently and economically.

"I consult the service and supply men whenever drilling is started in a new territory. They quickly give me the correct information on the area, because they know the operating problems. This saves me valuable time and provides for a planned drilling program.

"We are continually faced with the problem of drilling and completing deeper and deeper wells. The research departments of the Equipment and Service Industries have developed new and better materials to get this job done. Without the improved equipment we would really be up the creek. The Supply Stores stock needed materials, eliminating burdensome and costly inventories for the operator.

"With the cooperation of the manufacturers, the American Petroleum Institute has done a great job in its standardization activities. Their men have served the committees faithfully, giving unselfishly of their time and knowledge. Because their plants and offices, in many cases, are located outside oil and gas producing states, they have assisted us in defending the depletion provision in those areas.

"Manufacturing, service and supply companies are valued partners to me. They are always 'Johnny-on-the-spot' with equipment, supplies and know-how, when and where it is needed. These companies are made up of loyal, determined, aggressive men who, through their dedication and willingness to sacrifice, are 'oil men' in the truest sense of the word."

P.E.S.A.*

* PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION

PROUD TO BE PART OF A PIONEERING INDUSTRY

PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION

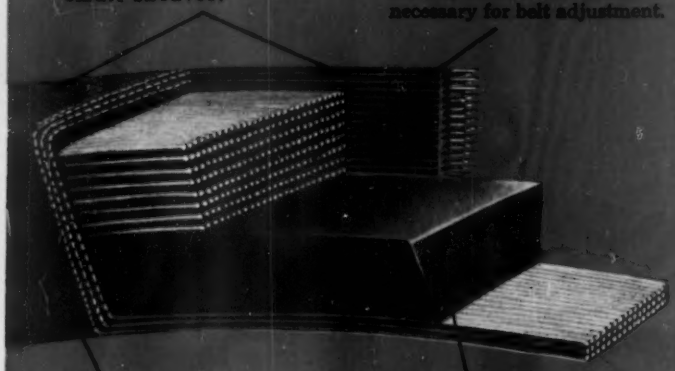
NEW C-E GREEN TRIANGLE SUPER V-BELTS

40% MORE CAPACITY

.. NO PRICE INCREASE

ALL NEW COVER cured by a special technique which molds NEW-type fabrics into a rugged, flexible unitized cover . . extends operational life . . bends easier over small sheaves.

ALL NEW CORDS *Each* fiber of the cord is impregnated with latex, not merely surface coated. Cords are built into the belt under tension with errorproof electronic precision, so *each* cord pulls its full share of the load uniformly with maximum shock resistance. Uniform tension on cords prevents belt turning over in grooves and reduces stretch, so less downtime is necessary for belt adjustment.



ALL NEW MOLDING PROCESS eliminates all inner and outer joints and laps for *even longer* belt life.

ALL NEW BOTTOM RUBBER COMPOUND has less heat build-up for longer life.

New materials . . new techniques . . the use of modern electronic equipment . . all combine to make possible the 40% more capacity in C-E Green Triangle Super V-Belts with *no price increase.* This means real economy! Fewer belts are needed to transmit the same horsepower on both new and existing drives. Belts are packaged in MATCHED SETS for uniform high quality, grade, size, diameter, strength and freshness . . sold exclusively through Continental-Emsco stores and representatives, worldwide.

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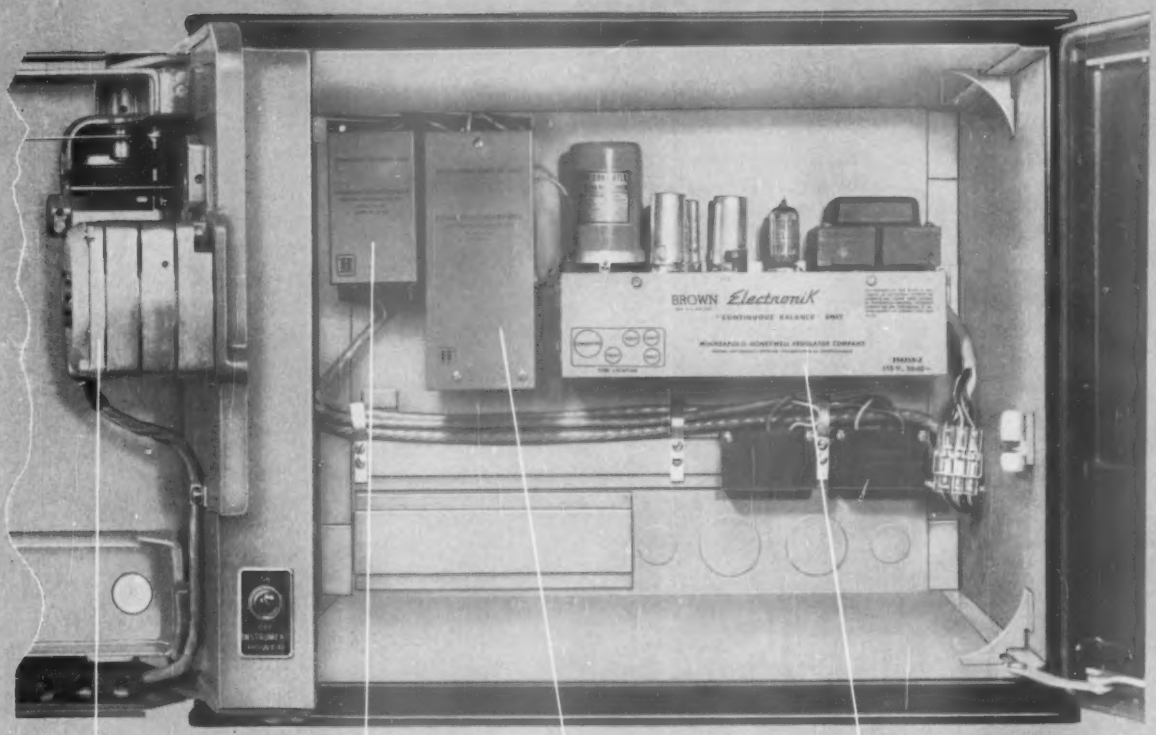
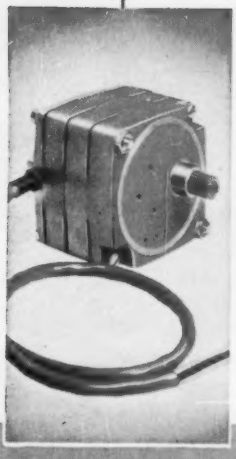
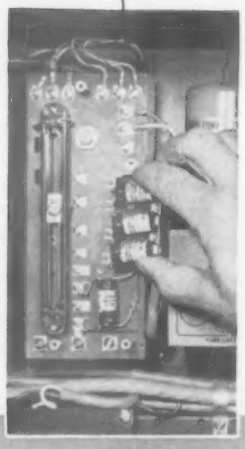


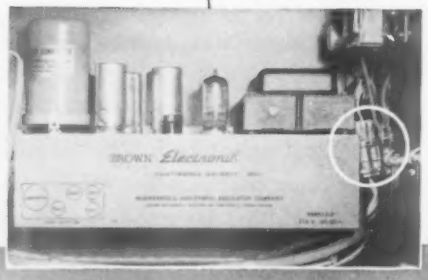


Servo Motor has sectional housing, leakproof oil wick, printed circuits for simplified servicing. Any major part can be replaced in 2 minutes.

Constant Voltage Module—Uses Zener diodes and an ambient temperature compensator to replace standardizing mechanism.



Measuring Circuit Module—Contains easily-changed range spool panels and vernier adjustment. Range is changed simply by replacing screw-clip panels of fixed resistors.



Amplifier Module—Quick-connect design permits fast, easy removal for servicing and replacement. Circle shows quick connect plug.

THESE FOUR NEW FEATURES ARE STANDARD WITH ALL *ElectroniK* POTENTIOMETERS

New modular design...

makes *ElectroniK* potentiometers easier to use and maintain

Now, four great new features add new operating and servicing ease to all *ElectroniK* circular and strip chart potentiometers.

- **New servo and chart drive motors are sectionalized so that any major part can be replaced in two minutes.**
- **A new constant voltage unit replaces batteries, standard cells and standardizing mechanisms.**
- **A new measuring circuit, with quick-change range spools, simplifies range changing and reduces stray pickup.**
- **A quick-connect feature lets you remove the amplifier for service and replace it quickly.**

Now, modular design is combined with the traditional precision of *ElectroniK* potentiometers, to give you a greater value than ever in accurate, dependable measurement and control.

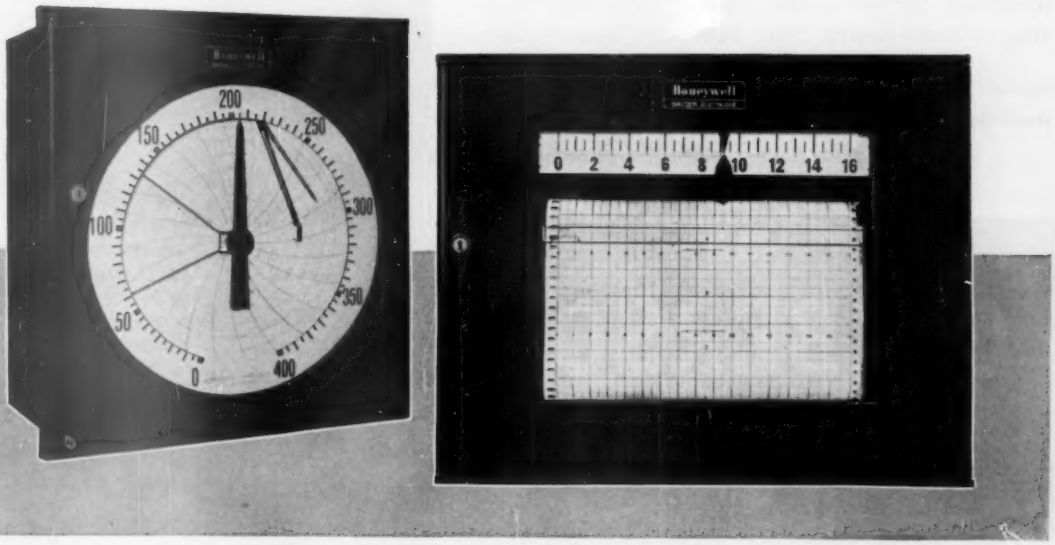
For full details, call your nearby Honeywell field engineer today. He's as near as your phone.

MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.

75th YEAR
PIONEERING THE FUTURE

Honeywell

First in Control
SINCE 1885



AUTOMATICALLY STOP TUBING BREATHING
and* BUCKLING . . *safely* . . *efficiently

GUIBERSON HM2 HYDRO-MECHANICAL TUBING ANCHOR

Install Guiberson HM2 Hydro-Mechanical Tubing Anchor and forget it. This anchor automatically adjusts for tubing stretch and contraction during pumping.

The HM2 is a *mechanically* operated anchor. A heavy spring keeps slips in a retracted position. When pumping, a pressure differential across the tool causes a piston to counteract the heavy spring; and, the upper spring mechanically forces slips into engagement with the casing. The piston then becomes a *static* seal; and thereafter, adjustments to well conditions are automatic.

Anchor moves freely down hole on pump's down-stroke . . automatically sets on upstroke. Tubing is held at its lowest level to prevent buckling and breathing for maximum pumping efficiency. Shear ring protects tubing from excessive tensile loads.

Install Guiberson HM2 Hydro-Mechanical Tubing Anchors and Start Pumping at Top Efficiency.

Sold by Oil Field Supply Stores Everywhere

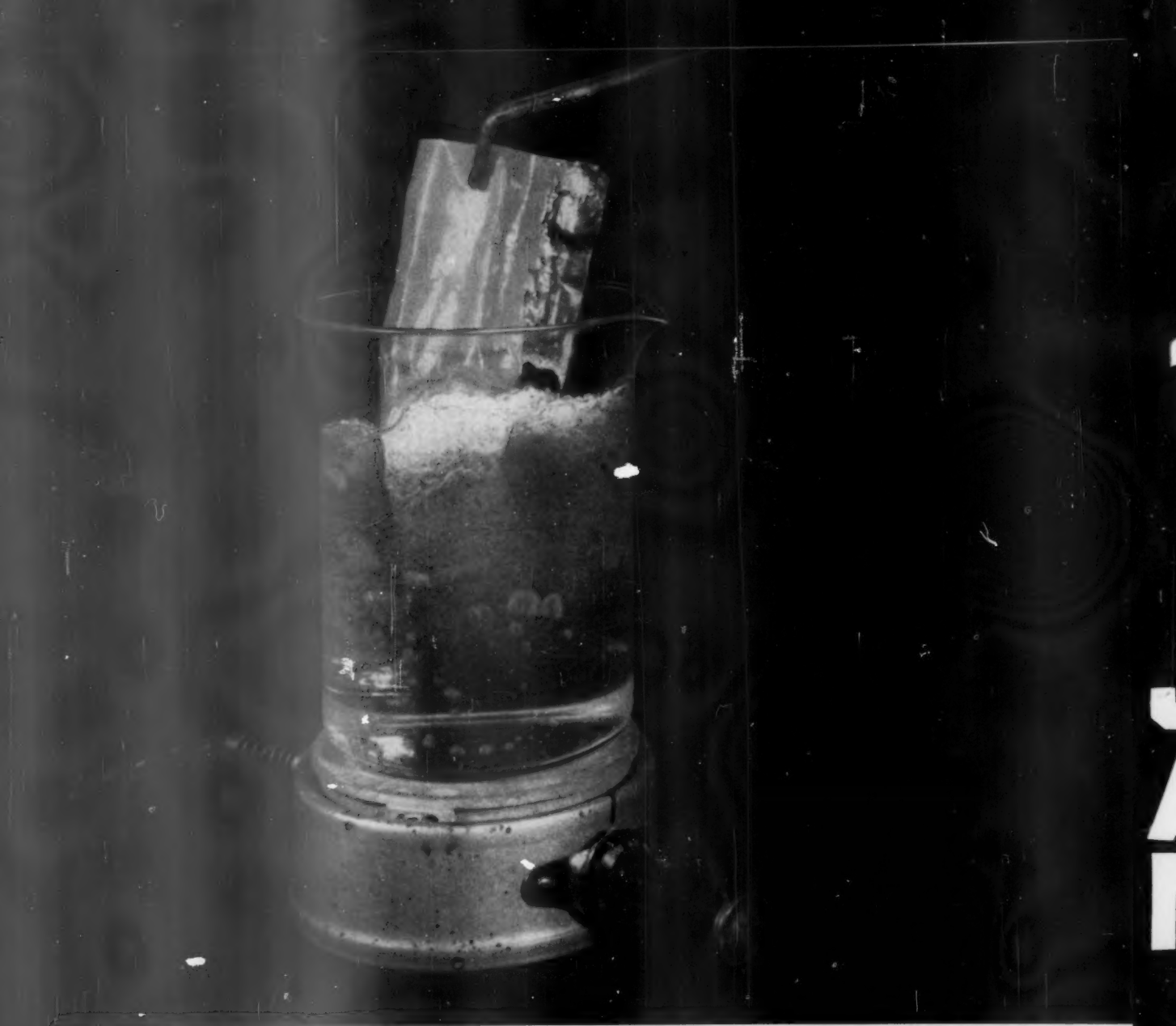
Fluid rising in tubing automatically sets anchor . . no surface manipulation required.
Anchored tubing prevents tubing and casing friction damage.
Dovetail head and slips insure smooth, safe operation.
Generous by-pass areas assure safe running — retrieving.
Design prevents hydraulic pressure in tubing from loading shear release.
Anchor is released by straight pull shear release or tubing manipulation.
Shear release causes an upward jar to disengage slips . . . lowering tubing string to release anchor is not necessary.

SAFE THAN SORRY BETTER BE GUIBERSON

THE GUIBERSON CORPORATION

ESTABLISHED 1919

DALLAS, TEXAS U. S. A.



Hot caustic can't foil this coating

A Glidden NU-PON COTE system was applied to foil and immersed in boiling 60% sodium hydroxide. The foil dissolved completely in a short time. The chemical resistant film was unharmed—and stayed that way!

Glidden coatings must submit to a whole battery of grueling tests such as this, because Glidden experts have to be sure before they recommend a protective system.

Glidden Protective Maintenance systems are designed to keep ships, marine installations, petroleum equipment, chemical plants, railroad rolling stock and industrial properties on the job under highly corrosive conditions.

QUALITY Glidden PRODUCTS

COATINGS FOR EVERY PURPOSE

The Glidden Company
INDUSTRIAL PAINT DIVISION
900 Union Commerce Building • Cleveland 14, Ohio
In Canada: The Glidden Company, Ltd., Toronto, Ontario

Write for your free copy of booklet containing complete information on all Glidden Protective Maintenance coatings.

PICKLED in a 4% brine solution!

CHOKED
in a tornado of abrasive dust!

FROZEN
for weeks at 75° C below zero!

BURIED ALIVE
in thick, sluggish mud!

nothing . . . but nothing stops Super-Seal open-type motors

Thanks to exclusive Poxeal and Silco-Flex insulations, Super-Seal motors have shown endurances that even enclosed motors couldn't match. Results and reasons available from your A-C representative or distributor. Or write General Products Division, Milwaukee 1, Wisconsin

ALLIS-CHALMERS A-1151

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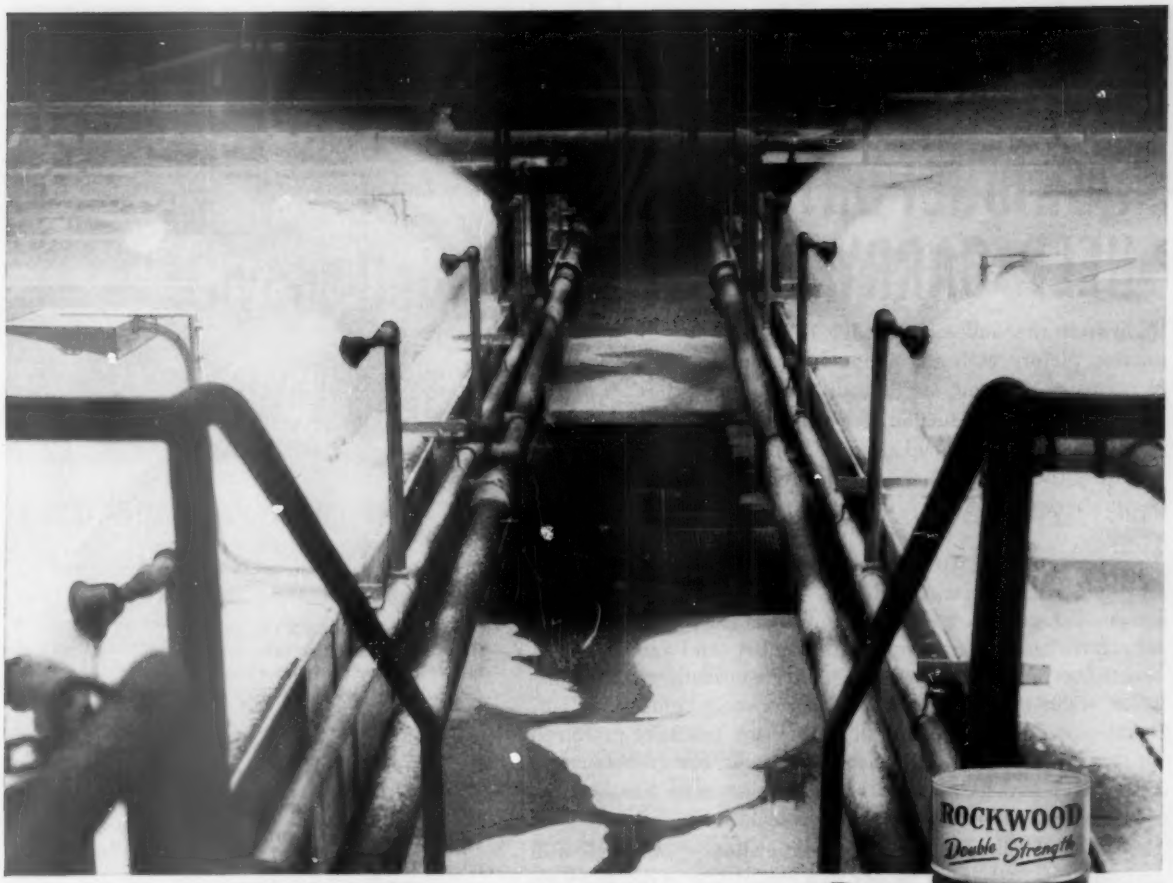


Testing a Rockwood FogFOAM System that guards the oil separator pits in Cincinnati Gas & Electric Co.'s plant.

Here's high protection *against* low flash-point fires!

Double Strength FOAM Liquid Gives Double Protection. Three parts of Rockwood Double Strength FOAM liquid mixed with 97 parts of water and 900 parts of air form a fire-smothering blanket that quickly reseals itself. You pay for only three parts per thousand for this extinguishing agent that has proved its ability to put out spill fires in flammable liquids, with maximum speed and safety for personnel. Tested and listed by Underwriters' Laboratories, Inc. Branch Offices in all principal cities.

In any group of oil separator pits, the pit with the lowest flash point sets the danger mark for the entire area.

To installations of this type — and to many others endangered by fire — Rockwood FOAM and FogFOAM systems bring the surest, most dependable fire protection ever developed.

In the FogFOAM system shown above, protection starts with the heat detectors located around the pits. During any critical temperature rise these detectors sense the inception of fire. The signal is transmitted automatically — and the FogFOAM system goes into instant action.

Rockwood FOAM liquid, mixed with water and air, is then released through many FogFOAM heads over each pit. Within a few seconds a thick blanket of Rockwood FOAM completely covers the threatened area . . . *A disastrous fire has been prevented.*

Fire protection systems are custom engineered by Rockwood to meet the needs of every type of oil and gas installation. Send the coupon for details.

ROCKWOOD SPRINKLER COMPANY

A Division of The Gamewell Company

Engineers Water... to Cut Fire Losses

Distributors in all principal cities

ROCKWOOD SPRINKLER COMPANY
A Division of The Gamewell Company
487 Harlow Street
Worcester 5, Mass.

Please send me information on Rockwood fire-fighting products and systems.

Name.....

Title.....

Company.....

City.....*Zone*..*State*.....

From the wellhead through the refinery gate BRIDGEPORT TUBES HELP CARRY THE LOAD

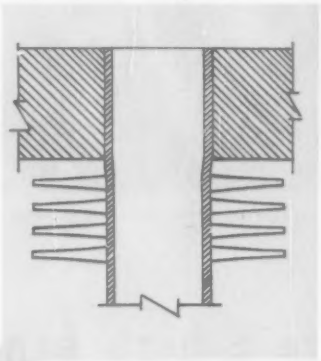
Right from the wellhead—Bridgeport is in the oil and gas production picture with aluminum, brass and copper base alloys in corrosion-resistant, single-wall and duplex tubes.

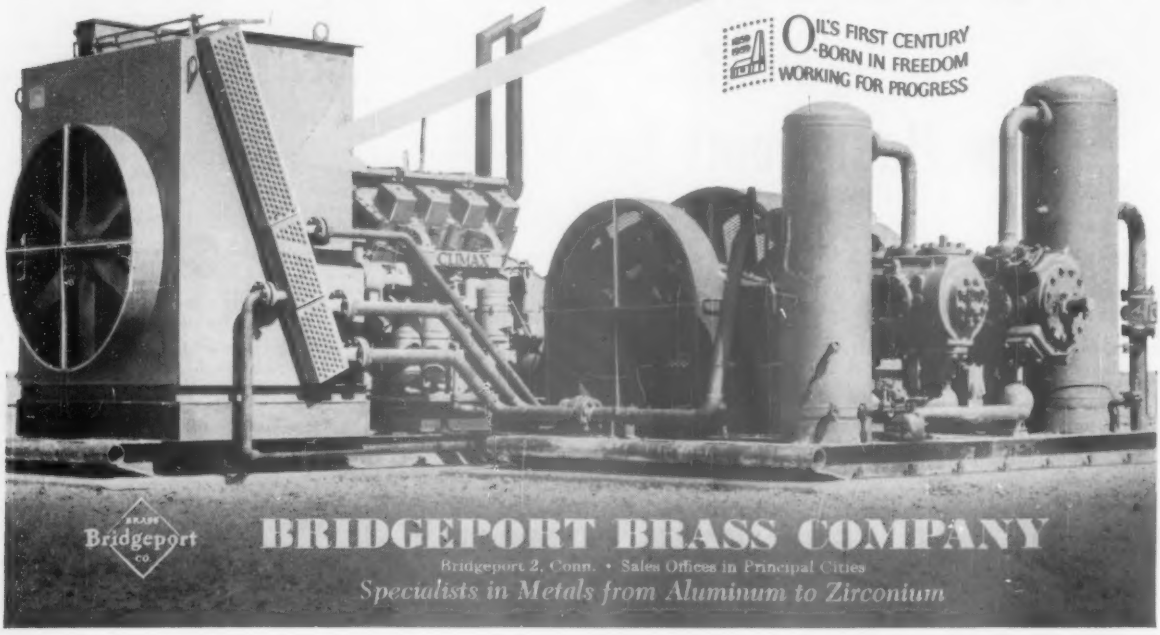
In natural gas production, for example, air-cooled heat exchangers at the wellhead do an around-the-clock job in both radiating the heat from the compressor engine and cooling the compressed gas before it is sent on its way to the gathering stations.

The air cooler illustrated here is manufactured by Air-X-Changers, Inc., Tulsa, Oklahoma. This model uses aluminum fins on Bridgeport Arsenical Admiralty condenser tubes. The tube bundles are mounted in a chamber, and fan-blown air across the finned surface cools either the compressor engine jacket water or the interstage and after-stage compressed gas. Bridgeport Inhibited Admiralty tubes are generally preferred for this type of service because of their corrosion resistance to both water and gas. And Bridgeport Aluminum Fin Stock is specially engineered for applications like this.

The range of Bridgeport condenser tube alloys—both single wall and duplex—is equaled by our vast experience in dealing with the special corrosive media encountered in the oil industry. This combination of quality products and technical engineering service pays you *all along the line.* Learn more about the benefits of Bridgeport Tubes and Technical Service for your applications. Write Dept. 5701.

Cross section of Air-X-Changer tube shows it expanded into tube sheet and individual aluminum fins positioned.





Engineering Progress Report

FROM UNION CARBIDE CHEMICALS COMPANY

Glycol Dehydrators give 90°F. Dew Point Depressions...

Improved regeneration systems give high glycol concentrations

There are two methods commonly used today to dehydrate natural gas: one employs glycols; the other, dry desiccants. Most authorities agree that glycol systems are less expensive in both initial and operating costs. Recent engineering advances now permit dew point depressions up to 90°F. with economical glycol-type dehydrators. Union Carbide Chemicals Company maintains an extensive engineering service group designed to help the natural gas industry obtain the best possible dehydration service with CARBIDE's diethylene glycol and triethylene glycol.

A GRADUAL IMPROVEMENT

Diethylene glycol was first used to dehydrate natural gas in 1936 and by 1939 sixteen glycol type plants were in service providing average dew point depressions in the range of 40°F. Triethylene glycol was first used to dehydrate natural gas in 1949. The dew point depressions realized with glycol type plants have gradually increased until today the standard guarantee is a 65°F. depression or gas containing seven pounds of water per MMSCF, whichever first occurs. For sometime now, some equipment manufacturers have offered a 75°F. dew point depression guarantee.

FACTORS INFLUENCING DEW POINT DEPRESSION

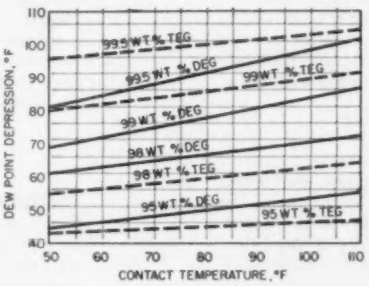
The dew-point depression obtained with a glycol dehydration plant depends upon several factors, such as:

1. Concentration of water in the lean glycol solution.
2. Glycol circulation rate.
3. Contact temperature in the top of the absorber column.
4. Efficiency of gas to glycol contact in the absorber.

Even with conservative design and operation, however, the dew point of the gas leaving the glycol contactor cannot be lower than the equilibrium value for the conditions of temperature and glycol concentration found on the top plate.

HIGH GLYCOL CONCENTRATIONS

The high diethylene and triethylene glycol concentrations now being obtained in plant practice, prompted studies to determine the dew point depressions obtainable with such solutions.



These data indicate that both diethylene and triethylene glycol at 99.5 per cent concentrations provide dew-point depressions in the 80°-105°F. range.

At concentrations of 98 per cent and lower, diethylene glycol provides better depressions than equal concentrations of triethylene glycol, while at 99 and 99.5 per cent concentrations, triethylene glycol appears to allow a 5°-10°F. lower dew point than diethylene glycol.

90°F. DEPRESSION MEETS TRANSMISSION REQUIREMENTS

Glycol regeneration equipment on the market today is capable of producing and maintaining glycol concentrations above 99%. Thus, it is possible for equipment manufacturers to guarantee a 90°F. minimum dew point depression. There are very few instances where a 90°F. depression will not meet the water content specifications of any long distance gas transmission company.

CARBIDE'S RESEARCH PROGRAM

Dew point depression studies are but one phase of CARBIDE's extensive research activities designed to improve the products and processes of the natural gas treating industry. CARBIDE's Technical Service Department stands ready to help you obtain the best possible results from your gas treating installations. For more information on the use of CARBIDE's glycols for gas dehydration, call the nearest CARBIDE technical representative or write, Union Carbide Chemicals Company, Department B, 30 East 42nd Street, New York 17, N. Y.

"Union Carbide" is a registered trade-mark of Union Carbide Corporation

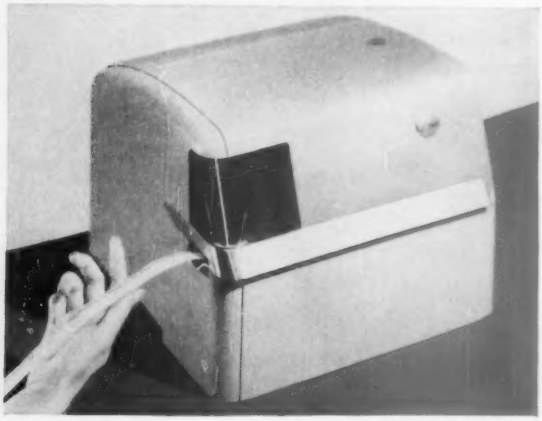
UNION CARBIDE CHEMICALS COMPANY
DIVISION OF
UNION CARBIDE
CORPORATION

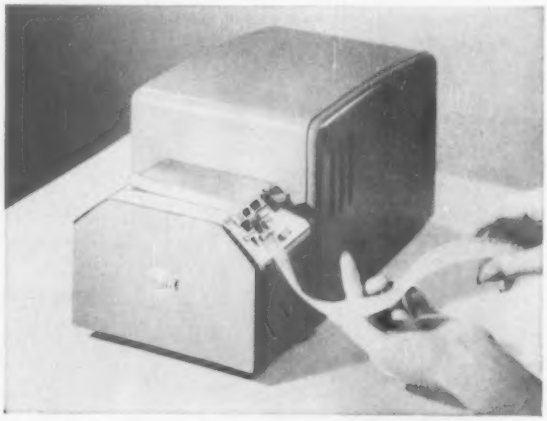
Teletype Model 28 Automatic Send-Receive Set A "complete station" in one console—with facilities for sending and receiving on message paper or sprocket-fed business forms . . . tape punching . . . sending or receiving with tape . . . integrating tape and manual keyboarding . . . producing tape automatically, as a by-product of send-receive operations.

Teletype Model 28 Receive-Only Page Printer A message receiving unit (without keyboard). This is "terminal" equipment, for use where two-way communication is not necessary. No attendant is needed. Produces a printed record on plain paper or multipart business forms. Table models of this unit and the send-receive set at the right are also available.

Teletype Model 28 Tape Punch Receives incoming electrical signals, punches a 5-level "common language" tape, and prints data right on the tape, for easy identification and handling. Unit is used for message relaying . . . for integrating data from several sources into a single tape . . . for providing punched tape as a by-product of send-receive operations.

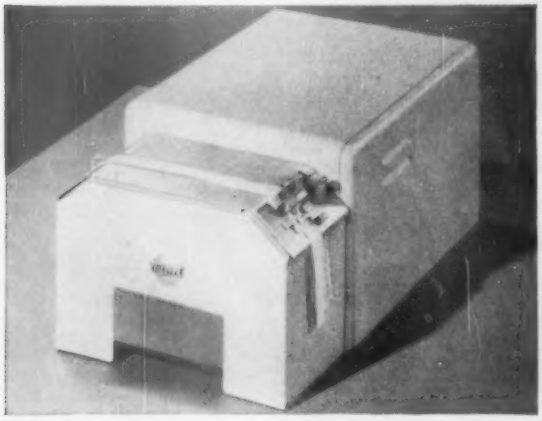
Teletype Model 28 Tape Reader This is a sending unit. Reads punched tape and instantaneously transmits data to local or remote receiving equipment. As with all Teletype transmitting units, data may go to one destination or a number of destinations simultaneously—either nearby or thousands of miles away.





Teletype Model 28 Send-Receive Page Printer Message originating unit, for sending and receiving. Model 28 page units, including the Automatic Send-Receive Set, feature a built-in "stunt box" control system for automatic station selection and electrical control of remote equipment. Horizontal tabulation and form positioning arrangement available.

Teletype Model 28 Tape Reader—Twin Shaft Besides reading punched tape for on-line transmission, twin-shaft reader-distributor design offers facilities for simultaneous output on a multi-wire basis and direct translation (without tape) of signals from an external parallel-wire source for on-line transmission.



For your communications system . . .

TELETYPE Model 28 Line

Presented here are the principal units of the Teletype Model 28 line. "Model 28" stands for an entirely new concept in record communications. It is an integrated line, designed on the modular principle, permitting a wide choice and ready interchange of components and providing accommodations for expansion. Typebox printing on page units makes possible quick interchange of alpha-numeric characters. Speed is 600 characters per minute with printing, up to 1,200 characters per minute on tape units where printing is not required.

These new machines are manufactured to Teletype's precision standards for continuous day-in and day-out service. All-steel clutches and simple harmonic-design elements greatly reduce and simplify maintenance requirements.

Exclusive with the Model 28 printer line is the versatile stunt box, which is actually a "robot brain." It responds to keyboard or line signals, and may be used for internal control of extra functions in the Teletype printer, as well as for external controls.

More information. If you would like more information on Model 28 equipment, please write to Teletype Corporation, Dept. *94A*, 4100 Fullerton Ave., Chicago 39, Illinois.

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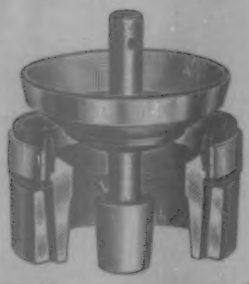
CORPORATION
SUBSIDIARY OF *Western Electric Company* INC.

GET THE MOST

Mission SUPER-SERVICE®



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Mission SILVER TOP®

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Because Mission Valves and Seats are designed to give you the most for your particular service. For *extremely high pressures*, the Mud Monarch® with an effective seal ring even when body and seats are severely worn. Compound 308® and Compound 711 inserts are available. For *medium pump pressures*, the Mission Super Service, with four cross arms for extra strength. And for *low and medium pressures*, the Silver Top with replaceable, wear-taking bushing which greatly reduces valve seat replacement. Compound 308 inserts are interchangeable with Super Service valves. Longer life is built in to all Mission valves and seats to give the most with all popular makes of reciprocating pumps. At supply stores everywhere.

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They Say—

Australian foresight

Dear Sir:

The oil industry often forgets about public relations and, in a Yankee-inclined country like Australia, one might think public relations would be the last thing to worry about.

Nevertheless, Magellan Petroleum Corp.'s call to exploration personnel of fellow American companies and of Australian companies operating out of Brisbane, has quickly resulted in the formation of QUPEX, Queensland petroleum exploration group.

The group is planning weekly luncheon meetings chiefly for exchanges of information, but already there is talk of using the group for public relations which will create a favorable atmosphere for exploration activities, financing, etc.

With the increasing tempo of arrivals of U. S. oil men visiting Australia, and particularly Brisbane, these luncheons will provide a rendezvous for visiting American oil people to meet the oil searchers based in Brisbane.

H. I. Harris
Chief Geologist
Magellan Petroleum Corp.
Brisbane, Australia.

A matter of survival

"We have just about reached the point where industry must be efficient as a matter of survival—and both management and labor must recognize that fact.

"If either misjudges the seriousness of the situation, we shall inevitably have economic chaos."

Millard E. Stone, vice president, Sinclair Oil Corp., in a speech to the Congress of American Industry, New York.

Atomic plants coming soon?

"We at Westinghouse have always been reluctant to predict when atomic plants will compete commercially with conventional facilities.

"Today, however, we are willing to go on record as believing that this time is just about here now . . . large nuclear power plants of a proven type can now be built which will produce electricity in some high fossil-fuel cost areas at a cost competitive with conventional plants.

"It is now possible to guarantee the

cost of these plants, their capacity, and the amount of fuel they will consume."

Gwilym A. Price, chairman, Westinghouse Electric Corp., in a speech to American Society of Mechanical Engineers.

Engineering responsibility

"It seems to me that the engineer today must not only assume more responsibility for the applications of his ingenuity, but must go further and, where feasible, attempt to join forces with the social scientist and those in nonengineering fields to insist and assist in the proper understanding and final end use of his technological contributions.

"This does not seem to be an entirely unrealistic nor inconsistent responsibility. It is one which we should expect to be a part of the total picture of professional engineering practice.

"The engineering profession should assume the initiative to establish understanding with nonengineering fields. This can be done only if engineers in key positions of administration and research will see and use opportunities for collaboration and be willing to support such joint ventures with money and staff."

W. R. Marshall, Jr., professor in the University of Wisconsin College of Engineering, in a speech to the American Institute of Chemical Engineers.

Oil bucks the trend

"Amid general alarm over pyramiding inflationary influences, the petroleum industry stands pretty well alone as contributing nothing to the spiraling trend.

"Plagued by more complex technological problems than almost any other economic enterprise, confronted by the necessity for vast capital expenditures, enduring the long uninterrupted climb in pay rates and other operating costs forced by inflation, the oil industry today turns out finished products priced just barely above the level of a decade ago.

"Actually, gasoline prices are keeping the cost of living from having a more devastating impact on consumers."

M. W. Jorz, oil editor of the Los Angeles Examiner, in an article in the Standard Oiler, magazine of Standard Oil Co. of California.

Early order

Dear Sir:

Your 1959 annual refining survey was very interesting. I would appreciate it if you would send us three copies of your 1960 annual refining survey when it is completed.

H. W. Stokes
Pana Refining Co.
Pana, Ill.

(Editor's note: This exclusive Journal feature will appear in the March 28 issue.)

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

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CALENDAR

JANUARY

11-13 Alberta Society of Petroleum Geologists, first international symposium on Arctic geology, Hotel Palliser and Jubilee Auditorium, Calgary.

11-15 Society of Automotive Engineers, annual meeting, Sheraton - Cadillac Hotel, Detroit.

15-16 Association of Oilwell Servicing Contractors, annual meeting, Baker Hotel, Dallas.

17-19 Kansas Oil Men's Association, annual convention, Broadview Hotel, Wichita.

18-20 Kentucky Petroleum Marketers Association, annual meeting and convention, Brown Hotel, Louisville.

22 Natural Gasoline Association of America, Gulf Coast regional meet-

ing, Robert Driscoll Hotel, Corpus Christi, Tex.

25-28 Plant Maintenance and Engineering Show, produced by Clapp & Poliak, Inc., Convention Hall, Philadelphia.

27-28 Western Petroleum Refiners Association, Gulf Coast regional technical-industrial relations meeting, White Plaza Hotel, Corpus Christi, Tex.

31-Feb. 3 Pipe Line Contractors Association, annual meeting, Ambassador Hotel, Los Angeles.

FEBRUARY

1-4 Instrument Society of America, instrument-automation conference and exhibit, Rice Hotel and Houston Coliseum, Houston.

8 Alberta Division of Canadian Petroleum Association, annual meeting, Hotel Palliser, Calgary.

7-10 American Association of Petroleum Geologists, Rocky Mountain section annual meeting, Billings, Mont.

14-18 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual meeting, Statler-Hilton and McAlpin hotels, New York.

21-24 American Institute of Chemical Engineers, meeting, Biltmore Hotel, Atlanta.

24-25 Wisconsin Petroleum Association, annual convention and exhibit, Schroeder Hotel, Milwaukee.

24-26 National Association of Corrosion Engineers, Tulsa section, eleventh annual corrosion short course, Mayo Hotel, Tulsa.

26 Natural Gasoline Association of America, Permian Basin regional meeting, Lincoln Hotel, Odessa, Tex.

26 Ohio Oil and Gas Association, winter meeting, Deshler-Hilton Hotel, Columbus, Ohio.

MARCH

2-4 American Petroleum Institute, Division of Production, southwestern district meeting, Statler-Hilton Hotel, Dallas.

6-9 American Society of Mechanical Engineers, gas turbine power and hydraulic conference, Rice Hotel, Houston.

7 Canadian Petroleum Association, annual general meeting, Hotel Palliser, Calgary.

7-8 University of Florida, annual heat transfer symposium, Engineering and Industries Building, Gainesville, Fla.

14-18 National Association of Corrosion Engineers, sixteenth annual meeting, Memorial Auditorium, Dallas.

16 Petroleum Equipment Suppliers Association, eastern district membership meeting, Duquesne Club, Pittsburgh.

16-18 American Petroleum Institute, Division of Production, southern district meeting, Hilton Hotel, San Antonio.

18 Natural Gasoline Association of America, Oklahoma regional meeting, Biltmore Hotel, Oklahoma City.

21-23 Midwest Gas Association, annual meeting, Hotel St. Paul, St. Paul.

22 Petroleum Equipment Suppliers Association, Gulf Coast district membership meeting, Shamrock Hilton Hotel, Houston.

24-25 New England Gas Association, annual meeting, Hotel Statler-Hilton, Boston.

28-30 Western Petroleum Refiners Association forty-eighth annual meeting, Hilton Hotel, San Antonio, Tex.

29-31 American Power Conference, annual meeting, Sherman Hotel, Chicago.

30-Apr. 1 American Petroleum Institute, Division of Production, Mid-Continent district meeting, Broadview Hotel, Wichita.

APRIL

3-8 Engineers Joint Council, sixth nuclear congress, New York.

4-7 Oil Heat Institute of America, annual convention, Park-Sheraton Hotel, New York.

4-7 National oil heat and air-conditioning exposition, Coliseum, New York.

5 Petroleum Equipment Suppliers Association, southern mid-continent district membership meeting, Statler Hilton Hotel, Dallas.

5-7 Instrument Society of America, national chemical and petroleum instrumentation symposium, Rochester, N. Y.

7-8 Rocky Mountain Oil and Gas Association, midyear meeting, Newhouse Hotel, Salt Lake City.

12-14 Petroleum Industry Electrical Association, Petroleum Electric Supply Association, conference and exhibition, Municipal Auditorium, Kansas City.

19-21 University of Oklahoma, College of Engineering, southwestern gas measurement short course, north campus, University of Oklahoma, Norman.

20-22 National Petroleum Association, semiannual meeting, Hotel Cleveland, Cleveland.

21-22 Texas Technological College, seventh annual West Texas oil lifting short course, Lubbock, Tex.

21-23 Society of Economic Paleontologists and Mineralogists, Permian basin section annual meeting and field trip, Abilene, Tex.

24-26 Independent Petroleum Association of America, midyear meeting, Denver Hilton Hotel, Denver.

25-26 American Society of Mechanical Engineers, maintenance and plant engineering conference, Chase-Park Plaza Hotel, St. Louis.

25-27 Southern Gas Association, convention, Buccaneer and Galvez hotels, Galveston.

25-28 American Association of Petroleum Geologists, Society of Economic Paleontologists and Mineralogists, annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

25-29 American Welding Society, annual meeting and welding exposition, Los Angeles.

26 Petroleum Equipment Suppliers Association, Pacific district annual membership meeting, Ambassador Hotel, Los Angeles.

27-29 Natural Gasoline Association of America, annual convention, Rice Hotel, Houston.

28-29 American Petroleum Institute, Division of Transportation, pipeline conference, Mayo Hotel, Tulsa.

28-29 Pacific Coast Gas Association, distribution conference, Benson Hotel, Portland.

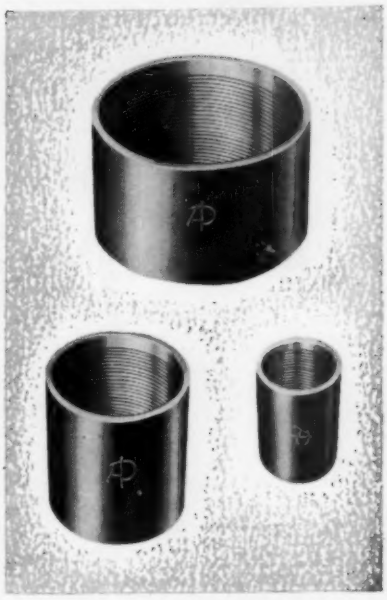
MAY

1-4 American Petroleum Institute, Division of Transportation, tanker conference, Seaview Country Club, Absecon, N. J.

2-3 Society of Petroleum Engineers of AIME, North Texas section, fourth biennial secondary recovery symposium, Wichita Falls, Tex.

5-6 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual joint meeting of Rocky Mountain petroleum sections, Calgary.

5-6 Canadian Institute of Mining and Metallurgy, annual technical meeting of petroleum and natural gas division, Palliser Hotel, Calgary.



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Century Electric 25 hp motor driving unit pumper in Harris County oil field.

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Here's why a Century Electric motor was selected to drive this Texas oil field unit pumper—

DEPENDABLE POWER. All Century oil field motors have these long-life features:

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Windings are insulated with tough polyvinyl acetal insulation which has great mechanical and dielectric strength.

Special stator insulation system includes several coats of high-temperature phenol-formaldehyde baking varnish . . . result gives protection against oil fumes, alkalis, dust and dirt.

Cast iron or steel frames are designed to withstand demands of the toughest installation.

Dripproof enclosure protects motor against rain, snow, dust and dirt. Rodent screens for dripproof motors prevent service interruptions at isolated installations. Totally enclosed motors are also available.

APPLICATION AID. Century Electric application engineers can help you get the right motor for your drilling, production pipe line or refining job from the 10,000 types Century makes. For instance, on the unit pumper shown above, one problem was to supply high starting effort. The Century Electric SCH motor with at least 200% starting torque does the job. Result: dependable motor power and lower operating costs. For more information contact your nearest Century Electric sales office or your supply store. For more than a motor . . .

CENTURY ELECTRIC COMPANY

St. Louis 3, Missouri *Offices and Stock Points in Principal Cities*

Century

59-19

the Journal said...

50 years ago

January 6, 1910

First trolley cars start running in Tulsa as initial phase of new electric railway system that eventually will link Sapulpa, Kiefer, Preston, Okmulgee, and Muskogee, and surrounding oil fields with Tulsa.

Fox River Oil & Gas Co., pioneer and discoverer of booming Preston field, in Okmulgee County, Oklahoma, sells its holdings to Producers Oil Co. for $325,000. Deal includes three producing wells.

Sen. M. L. Lockwood, of Sabine Oil & Marketing Co., pushes project for U. S. Government to build steel storage terminals along the Gulf Coast, fill tanks from present overproduction, and burn the oil in warships.

25 years ago

January 3, 1935

Big flush wells in Reno and Russell counties credited with boosting Kansas oil production to new peak. Output for past week averages 142,750 bbl. daily.

East Texas field closes year of 1934 with natural-gasoline output of 46,800,000 gal. compared with 20,000,000 gal. for previous year. Huge increase places field among important sources of this product. New plant expansion expected to raise output during 1935.

Conroe opens 1935 as top Gulf Coast field in oil production with daily flow above 38,600 bbl. Other coastal leaders include Barbers Hill, 20,000 bbl. daily; Leesville, 18,700 bbl.; and Iowa, 17,500 bbl.

10 years ago

January 5, 1950

Spectacular salt mine cave-in creates crater 180 ft. long, 115 ft. wide, and 50 ft. deep in old Blue Ridge salt dome field, 10 miles southwest of Houston. Production of many wells juggled.

Pacific Refiners, Ltd., affiliate of Honolulu Gas Co., awards Fish Engineering Co., of Houston, contract for construction of Hawaii's first refinery. Projected 3,000-bbl. complete butane-asphalt plant scheduled for operation next June.

United Gas Co. adds 40 new gas wells in 33-year-old Monroe field in one of North Louisiana's largest single drilling programs. Project, started last April, boosts company's available gas in this field more than 40,000 M.c.f. daily. Well depths range from 2,100 to 2,250 ft.

JOURNALLY SPEAKING

Edwin L. Drake, R. I. P.

FOR SEVERAL MONTHS we have been waiting for this opportunity to write the final obsequies of Colonel Drake.

All during the centennial year of 1959 we heard, over and over again, the story of how he started this business 100 years ago and of all the marvelous things the oil industry has done since.

Seldom has an obscure personality been so publicized. The oil industry's public-relations efforts in this behalf undoubtedly convinced a majority of the American public that this bearded gentleman was not one of the cough-drop Smith Brothers, though a good many people perhaps still have him confused with Fidel Castro.

It was all good, clean fun to recall the early days of oil and to cogitate on how naive and how valiant the early pioneers were. The study of history is interesting, and it can be instructive if the lessons of the past are applied to the problems of the future.

But in turning the clock back 100 years, the oil industry, like any reminiscent oldster, ran the danger of dwelling too much in the past and forgetting that today's conditions demand forward looking. For the sake of the industry's mental health there was a little too much glamorizing of the adventurous wildcatter back in the long-gone free-wheeling days when oil was where you found it and once you found it everything else would take care of itself.

The Drake ballyhoo did, incidentally, get in some good plugs for the fact that oil is a good and necessary fuel, and that the industry's scientific skills have increased mightily in the past century.

Now that Drake's achievement has been properly noted, and his title of colonel been made official posthumously, it is time for the industry to forget about both 1859 and 1959 and concentrate on the Surging Sixties.

The public-relations task now is to convince the people that not only is oil a good fuel but the oil industry is a good industry and operates in the public interest; that not only have the industry's scientific skills advanced, but also its skills in the fields of economics and political science.

During the next few years the industry's traditional habits of economic thinking will be as out of style as Colonel Drake's chin whiskers and stovepipe hat, and operators who don't adapt may be just as dead as the good colonel himself.

But, as we tell our children who are enamored with the adventurous days of the "westerns" on TV, there are plenty of challenges today for the resourceful and the enterprising.

Much pioneering lies ahead in the oil business. There are mountains of surpluses to be scaled, raiding bands of competitors to be fought, rivers of red ink to be forded, and trails to be blazed through the wilderness of government regulation.

Colonel Drake and the other oil pioneers improvised tools and equipment, and tried one thing after another in learning how to find oil and to complete wells. In a sense they, and their spiritual descendants in the laboratories, did their job too well. The industry's science has run ahead of its economics. We have more oil than we know how to handle.

Drake's plan for making a profitable business for himself and associates out of rock oil was swamped by a flood of uncontrolled surplus production and unrestrained competition. At that time the only thing anyone knew to do was to wait until time brought correction. A hundred years later oil men face the same problems, but should be able to find a better solution.

So now that the industry has dutifully laid a wreath on Colonel Drake's headstone, let's forget about him and his era and turn attention to today's affairs and what lies ahead.

As the British so aptly epitomize this concept of change: The king is dead; long live the king.

Henry D. Ralph

Better Cementing Starts with **CENTERED CASING and a Good BONDING SURFACE**

BAKER CASING CENTRALIZERS assure cementing clearance—no "balling"—no plugged annulus. When running in the hole their "sled-runner" springs do not remove mud cake which can plug the annulus, cause pressure surges, and restrict production. These strong, quality steel springs are securely butt-welded to collars; then pre-set so that they pass tight spots or dog legs and still retain all of their original ability to provide greater centering force. Available in HINGE-LOK OR SOLID-RING models, and in all required sizes and types from "slim-hole" to "extended range."

BAKER WALL SCRATCHERS prepare the cementing area for an effective cement bond. They glide down the hole without removing mud cake which can stick the casing, plug the annulus and build up pressure surges. When activated at the cementing area, the undamaged scratcher wires remove mud cake to ensure successful bonding of cement to formation. RECIPROCATING Scratchers (top view) are available in Solid-Ring or Hinge-Lok types with long or short wires as specified. ROTATING Scratchers (below) are furnished in five-foot sections, each with 48 scratching points which readily remove mud cake from the well bore, even under varying clearances.

BAKER HAMMER-LOK STOP RINGS retain scratchers and centralizers positively at the point of installation. You can avoid harmful welding on high-strength casing (such as N-80) and still maintain ample holding force with the new, easy-to-install Hammer-LOK Stop Rings which are quickly installed while the casing is on the rack, or while hanging in the rig. By merely flattening the locking wedge with a hammer, the ring grips the casing so securely that it will resist a vertical force of as much as 35,000 pounds, according to laboratory tests. The effective initial placement of centralizers and scratchers is thus maintained.

BAKER OIL TOOLS, INC. HOUSTON LOS ANGELES NEW YORK

The Baker representative in your area is a primary cementing equipment specialist; call him in advance of your next cementing job.

Accent on youth is oil's promise for the sixties

FOR THE OIL INDUSTRY, the New Year's bells this year ring out the old and ring in the new with more than mere symbolism.

They ring in a new year, a new decade, a new century of oil. They ring in a whole new economic climate, a new environment of operating conditions, a new set of problems.

This New Year's bells are alarm bells, signaling the industry to wake up to changes, get up to date in thinking, cheer up to opportunities abounding.

SOMETHING ELSE IS NEW—a new generation of oil men. There is hardly a company that hasn't been putting a new crop of young executives into its upper levels of management. This will bring some big changes in the conduct and the personality of the business.

For a century the oil industry was strongly influenced by the psychology of the wildcatter. Perhaps unconsciously it was characterized by plunging, by hunch playing, by dominant personalities, by boom conditions, by rapid growth, by dependence on volume rather than efficiency.

The decade of the sixties will be shaped by oil executives of a new school of thought—men trained as scientific managers, motivated by the corporate view of long-range planning and stability, instilled with fresh approaches to economic problems.

These new pace setters will shake up old traditions. Their decisions will combine the optimism and originality of youth with the careful calculations of modern management methods. Their new concepts may jar some old timers, but the whole industry will profit from them.

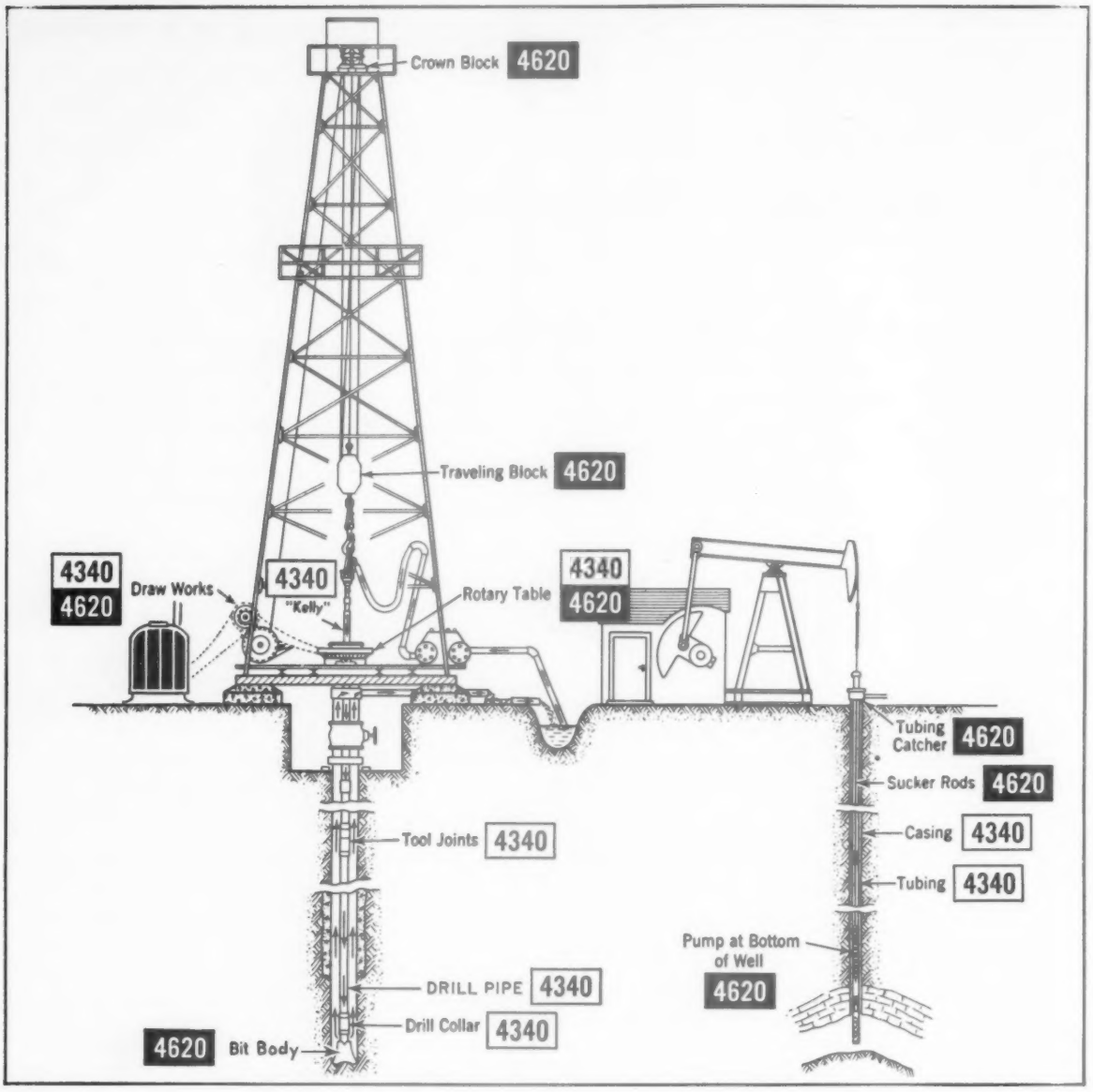
It is often said that the oil industry's greatest asset is its competitive spirit. The oil leaders of the oncoming generation will direct this competition into some surprising new channels.

They will not be content, for example, with the old hypothesis that profits lie in finding and producing oil, not in refining and selling it. They will develop new ways to make a profit on the oil they have, perhaps by diverting research talent from exploration to new and widened uses for petroleum products, new and more efficient methods of marketing.

RESTLESSNESS FOREBODES CHANGE, and the industry's dissatisfaction with conditions of the past few years is of itself forging new opportunities for improvement.

The industry faces a series of musts. It must find ways to cope with surpluses, to cut costs, to increase efficiencies, to yield adequate profits in all its branches and activities.

This is the challenge facing the younger pilots now taking over so many important helms. In them lies the industry's chief promise for renewed vigor and progress in 1960 and the years to follow.



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When you need through-hardening alloy steel, simply specify 4340. It's ideal for parts of medium-to-heavy section size. It provides exceptionally high strength and toughness. Responds reliably to heat treatment. It's weldable under proper conditions and machines at relatively high hardness.

And when you need a carburizing steel, simply specify 4620. It resists warpage and distortion in heat treatment. Responds reliably and uniformly, too. Provides good core and case properties.

Best of all, both are carried by Steel Service Centers from coast to coast, ready for delivery right off the shelf. If you need steels with more specialized properties for particular applications, the proper nickel alloyed grades are also available from your Steel Service Center. If you'd like a Buyer's Guide of centers that carry 4340, 4620, and other nickel alloy steels, it's yours for the asking from Inco.

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THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N.Y.

Top Oil Men Look at '60—and Beyond

• Thirteen chief executives tell what to look for in the year, and in some cases, the decade, ahead. There's optimism, with warnings; problems, coupled with hope. To check your own thinking, here's how they see the future.

P. C. Spencer, Chairman
Sinclair Oil Corp.

IN SPITE of the fact that a splendid job has been done in bringing product inventories into good supply-demand relationship, and in spite of the fact that crude inventories are at satisfactory levels, current product prices are perhaps 1 cent per gallon less than they should be on a compensatory basis.

It seems clear that whereas the mandatory imports program has held the line on import volume it has not brought health to the industry, which was its purpose.

The job of bringing health to the industry out of these conditions in 1960 will challenge the ingenuity, the managerial skill, and the statesmanship of all those who sincerely want a healthy domestic industry.

Paul Kayser, President
El Paso Natural Gas Co.

AS FAR as we can see in the natural-gas industry, the year 1960 is going to be an exceedingly active year.

Expansion will not be as easy as heretofore, but the actual rate of expansion probably will be as high as ever. The consolidation of markets and completion of various expansion programs that have long been in the making will probably hold construction to a high level.

T. S. Petersen, President
Standard Oil Co. of California

THE U. S. petroleum industry in 1959 saw its domestic demand exceed 1958 by 5% with a similar gain in crude production. The year proved somewhat disappointing, however, as product and crude prices weakened generally with oversupply the principal factor in the fall-off.

In 1960 the industry can look for demand gains of 4½ to 5%. A principal factor in stabilizing supply will be the import controls, which will experience their first full year of operation during 1960.

Under these conditions refiners can look for improved margins and a strengthening of light product prices. Though rising costs would seem to justify a boost in crude prices, such increases do not seem too likely particularly in the early part of the year.

Free foreign demand should continue its 1959 rise of about 8% in 1960.

The tanker market, on the other hand, will remain weak until shipping needs catch up with tanker availability. Due to the sizable portion of the fleet in lay-up, no strong rate boosts are anticipated.

John E. Swearingen, President
Standard Oil Co. (Ind.)

IN THE DECADE of the Sixties, three great opportunities exist for the oil industry:

1. To accelerate the application of new knowledge in technology, marketing, and management. By utilizing these advances, the industry should be able to provide better and cheaper service to its customers, and at the same time achieve more profitable sales and a higher return on investment.

2. To expand the markets for oil products of all sorts, not only in the United States but throughout the world.

3. To communicate more effectively. There is an urgent need to attain a broader understanding between management and labor to show that the fruits of progress should be shared by the public, stockholders, labor, and management. It will be increasingly necessary to demonstrate to the lawmakers how our business can be run most efficiently with minimum government intervention.

1960 will be a year of transition. We will continue to have problems of oversupply of crude oil and products, but a sustained high level of general business activity should be shared by the oil industry.

R. L. Tollett, President
Cosden Petroleum Corp.

EXPLORATION for and development of domestic crude oil and gas reserves is still a good business. Limitation on production and sales thereof extends the period

Spencer | Kayser | Petersen | Swearingen | Tollett

Holman

McCollum

Taliaferro

Willetts

required for return of capital investments, but still not to an unreasonable degree.

The existence of excess domestic refining capacity will continue through 1960 and perhaps until 1961. Normal increases in demand, coupled with unavoidable obsolescence of refinery processing equipment, will surely eliminate excess refining capacity by the end of 2 years.

Refiners' margins are likely to be thin over the first half of 1960, but reported gross margins are not the only measure of profit possibilities. Refiners and marketers are beginning to retain a greater portion of their margins through reduction in processing costs and selling expenses.

Eugene Holman, Chairman
Standard Oil Co. (N. J.)

IN 1960, the increase in free world petroleum demand is expected to be somewhat better than 5% or nearly 1,000,000 bbl. per day. This prospect reflects an estimated gain in the United States of about 4% and nearly 7% abroad.

Looking a bit further ahead, we see great prospects for growth in demand for all kinds of energy and, particularly, petroleum energy. By 1975 we think the free world's consumption of oil will be around 14,000,000 bbl. a day higher than in 1958. Certainly Jersey Standard's operating affiliates expect to participate fully and profitably in this anticipated increase.

As for 1960, marketing and refining growth abroad, and projected nation-wide marketing in the United States, where the company is consolidating all its producing, refining, and marketing operations into one organization, give us reason for further optimism.

Jersey's billion-dollar spending program for 1960 will be divided into about 17% for marketing, 21% for refining, 14% for transportation, and 48% for producing.

L. F. McCollum, President
Continental Oil Co.

BY ALMOST any measure, the decade ahead is going to be one of explosive growth world wide. The oil industry will share in this growth, and in so doing will ease the industry's most pressing problem—overcapacity.

The industry has normally had overcapacity and probably always should have. The present problem is mainly one of degree—our unused capacity is twice the level usually considered adequate. This has tempted many to try to utilize this spare capacity, as witness the high inventory levels prevailing through the past year.

There are two routes to alleviating our present difficulty. First, in planning for the future, we should recognize our excess capacity in all phases of the business. There is already evidence that capital investment planning is looking more toward the area of improving efficiency and reducing costs than toward increasing capacity. Second, we should learn to manage our excess capacity wisely.

It is encouraging to review the progress of the industry's cost reduction efforts. In the producing side of the business, greater emphasis is being placed on wider well spacing and increased use of secondary-recovery techniques. Automation is being applied with marked success to the transfer of oil from lease tank to pipelines, on to refineries, in the refineries, and finally at terminals. Marketing operations are coming under closer scrutiny, with emphasis directed toward more volume through fewer outlets.

While it is encouraging to see the progress being made, the industry should not overlook some other disturbing factors facing us in the years ahead. There has not yet been a full realization by the consumer and some distributors of the necessity of paying adequate prices for gas to provide incentive in the future. The present inadequate prices being received by the producer will inevitably bring about shortages.

Paul E. Taliaferro, President
Sunray Mid-Continent Oil Co.

IT IS remarkably clear that almost everyone expects more boom.

Many economists are saying that the steel strike did the long-range economy some good. It was in itself a recession and may therefore have postponed for some time the cyclical leveling off expected by some every 30 months or so.

Business, then, should be good throughout 1960 and well into 1961. Oil economists expect another 3 to 5% gain for 1960. We go along with this at Sunray.

As an industry, we are producing about 75% of our domestic capacity; our refineries are operating at about 80% of capacity; and it is generally agreed that the industry has, in many areas of the country, more marketing outlets than these areas can economically support. It is obvious, then, that we must fully recognize this situation and prepare to meet it head-on if we are to continue to make reasonable profits.

Herbert Willetts, President
Mobil Oil Co.

MOBIL estimates that demand for oil products in 1960 will increase over 1959 by about 4% in the United States. The increase in 1959 was about 4%.

In addition to the effects of the protracted steel strike on general economic activity, oil has been beset by economic and political problems largely peculiar to the industry.

The prime economic problems include:

1. Oversupply, resulting from excess worldwide producibility of crude oil, excessive refinery runs in the United States, and surplus tanker tonnage.

2. Slimmer profit margins, stemming from oversupply and from the sharpening competition in an already severely competitive industry.

3. Continuing sizeable capital investments, even if on a reduced scale, in a time of reduced profit margins.

4. Rising costs and the threat of further inflation.

Spahr

Vickers

Supplee

Getty

The main political problems—often inseparable from the economic difficulties—embrace:

1. Misunderstanding of, and consequent attacks on, percentage depletion.

2. Continued federal regulation of the wellhead price for natural gas under utility-type controls which have no proper place in such a competitive risk activity.

3. Certain features of the oil import regulations, such as government surveillance of prices in a strongly competitive industry and the inequities involved in the bases for allocating import quotas.

4. High taxes on gasoline which are forcing motorists to bear a disproportionate share of the total tax burden.

5. Special-interest pressures for further government intervention in the form of, for example, end-use controls on fuels and arbitrary regulations on shipping.

Charles E. Spahr, President
Standard Oil Co. (Ohio)

THERE is general agreement that the over-all business outlook for 1960 is excellent, assuming that satisfactory labor agreements can be reached in a number of industries. In terms of demand for its products, the petroleum industry should benefit from any improvement in business activity. In terms of profitability, much depends upon the initiative of the management of the individual companies.

The demand for petroleum products during 1960 will exceed 1959 by about 3.7%. Competitive pressure in all branches of the industry will continue to require increasing sales efforts and more effective use of resources and facilities in order to earn reasonable profits.

I do not intend to minimize the problems facing the entire industry, but I am not pessimistic about the future.

Excessive production and refining capacity have temporarily impaired the health of the industry. It is hoped that recent experiences will result in focusing the attention of individual companies on the problems of balancing supply and demand. Because of the intensely competitive nature of the petroleum industry, this alone will not guarantee improvement in the depressed product prices, but it should restore a more healthy climate in which improvement could be expected.

Jack A. Vickers, President
Vickers Petroleum Co., Inc.

PROVIDED steel and transportation difficulties are settled, 1960 should be the most profitable year ever for Vickers Petroleum Co., Inc.

This idealistic objective will be accomplished primarily through strengthened management which will closely supervise programs already in force. Our cost control and cost reduction projects, as well as inventories and manufacturing, will receive closer supervision than ever before.

An expansion in a variety of areas, particularly marketing, will result in 1960 being a banner year for Vickers.

Henderson Supplee, Jr., President
Atlantic Refining Co.

THE INDUSTRY'S greatest problem at the moment is probably that of surplus capacity, in both refining and crude producing.

In refining, excess capacity has led to overproduction of products and weak prices. Recently, however, building rates have slowed almost to a stop, and demand has resumed its upward trend. Operations should be closer to capacity in 1960, and, with increasing awareness of the market implications of excessive capacity, there is hope supplies will be more in balance with requirements.

The prospect of improving the situation in crude producing is much less clear. Neither state regulation nor import controls have as yet been wholly effective devices for strengthening domestic oil markets. However, since crude stocks had a heavy drawdown in both 1958 and 1959, the effect of import limitations may become more apparent in 1960.

Thus, the domestic crude picture may look somewhat brighter in 1960. Nevertheless, the over-all crude situation is likely to be difficult for some years. As North Africa and other new oil sources are added to existing supplies, a whole host of problems are going to arise in finding outlets for free-world oil.

In the U. S., the rate of growth of demand is tending to slow, even though it will continue to increase in absolute terms. To meet this situation, the oil industry must find and promote new uses for its products and compete more vigorously with other fuels for existing markets. Petroleum is a versatile raw material, and certainly the products we can make from it and the uses to which we can put it have not been exhausted. This is perhaps our most challenging problem for both 1960 and the longer run.

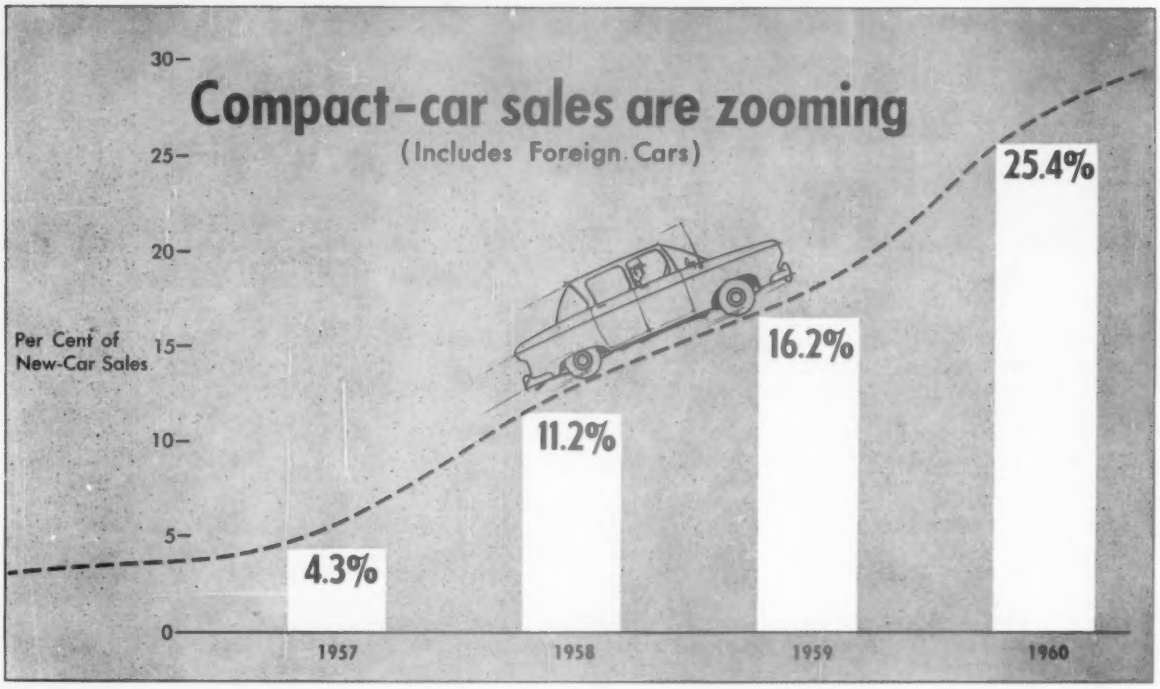
George F. Getty II, President
Tidewater Oil Co.

AT TIDEWATER we see a steady increase in demand in the decade ahead, with the temporary excess manufacturing capacity disappearing in the need to satisfy the rapidly growing U. S. population and the nation's persistently expanding energy requirements.

But the 10-year period will not be without its problems. There will be competition from natural gas, future increases in gasoline taxes, and legislation affecting marketing as particular challenges to the industry.

Retail price of gasoline, already well behind that of other consumer products in the price climb of the '50's, could continue to fall behind the rest of the economy if additional taxes are added. The administration is already considering a new gasoline-tax increase, although the most recent tax is not yet 6 months old.

Dealer relations will become more important to all integrated and marketing oil companies. The rise of dealer associations, and the threat of divorcement legislation and other regulation by state and federal government in the '50's, were only preludes to what will come in the '60's.



How Compact Cars Will Affect Oil

- As Detroit turns more to economy rather than power, refiners will be freed from some of the pressure to turn out higher and higher octanes. The compacts will focus the spotlight on a better-grade regular.
- A little less gasoline will be sold as result of compacts, but gasoline consumption will continue to rise due to the increase in the car population.

AMERICAN-MADE compact cars, making their debut across the country this year, may make some Cadillac-size changes in what the motoring public will require from the oil industry.

One thing appears certain: Compact cars will slow down the trend toward higher compression ratios.

To the refiner, Detroit's new emphasis on economy will mean increased demand for regular-grade gasoline. With so many of the 1960 cars designed for regular, the overall octane requirement curve for 1960 models is slightly lower than 1959.

Based on the short time compact cars have been available, here's what you can reasonably expect from compact cars:

...**Sales of compact** and foreign cars will account for 25% of the new-car sales made in 1960.

...**Fuel consumption** in 1960 for passenger cars will be 2% below what it would have been if all cars were of standard size. By the end of 1960 probably 6% of all cars on the road will be compact or foreign cars.

...**Regular-grade gasoline** will be fueling about 72% of the 1960 passenger cars with premium serving the remaining 28%. Octane requirements for both regular and premium will be up slightly in '60 over '59. Fuel requirements for the compacts will fall some where between the 1959 sixes and the highest regular-grade V-8's.

There are many "if's" about just how the compact car will alter the automobile future, but right now here's how the compacts are expected to affect some major fields:

1. Sales

The swing to smaller cars is firmly under way. The high priority compacts are getting in Detroit was pointed up during the steel strike. The last line shut down by General Motors was its Corvair plant—and Corvair was the first plant back in operation when Taft-Hartley was invoked.

Based on the estimate that 25% of the new-car sales in 1960 will be compact or foreign cars, 6% of all cars on the road this year will be small cars. And one out of every five may be a small car by 1965.

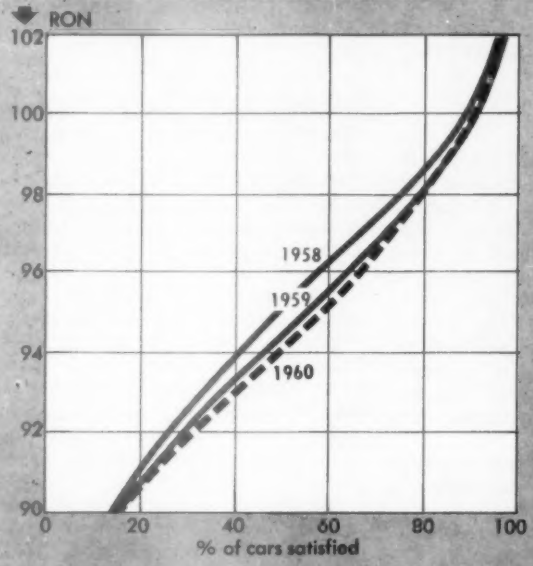
Here is the way compact sales break down for the last 3 model years and how the market will probably split in the 1960 models:

During 1957 and 1958, compacts were 70% imports and 30% Ramblers; in 1959, 50% were imports, 37% Ramblers, and 13% Larks; in 1960, the Big Three compacts (Corvairs, Falcons, Valiants, and Comets) will get an estimated 40% of compact sales, imports 30%, and Ramblers and Larks 30%.

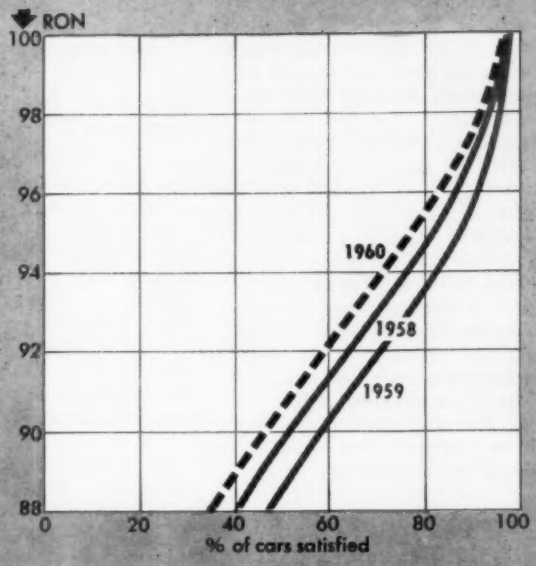
The critical year for the compacts will be 1961. Detroit will have a pretty

Octane requirements take some odd twists

New-car requirements are down . . . but total-car requirements are up.



Compact cars and the growing number of other cars requiring regular fuel are helping pull down octane requirements for new cars. The curve was down for 1959 models and dropped again this year.



Despite the drop in new-car octane needs, octane requirements for all cars on the road are climbing. This is due to low-octane klunkers being replaced by new cars which—even if they're compact cars—require a higher-octane fuel.

good idea by then just where the compact will fit into the picture. If compact-car sales run high, then the 1961 model standard-sized cars will be more compact than their 1960 counterparts.

In fact, it looks as if the sharp line of demarcation between the present three sizes of cars will be erased by 1962. Currently, cars fall into three groups: The small foreign car; the new compact car; and the standard-sized car. The first two are expected to get bigger in the years ahead and the third group smaller.

Detroit is planning some compacts as small as the Metropolitan. Ford is due out next spring with the Mercury Comet, which will be a compact. And General Motors is tooling to build a compact version of the Buick, Olds, and Pontiac.

For the car buyer, this means he'll have a wide range of sizes to pick from—and they won't be grouped into three distinct sizes.

2. Fuel Consumption

The compact-car owner should be able to improve his mileage and save about $60 a year on his gasoline bill.

From the economy standpoint, the standard sized six-cylinder car with a manual shift will average about 16 miles per gallon. The compact car, because of its reduction in weight and smaller engine, will give about 24 miles per gallon or a 50% improvement. The Volkswagen and Renault will give about twice the fuel economy of the present six-cylinder car.

Fuel consumption will continue to rise in the U. S., but not at the same rate of the pre-compact car days. The better mileage possible with compacts will cut the 1960 fuel consumption total down about 2% below what it would be if all cars were standard size. And by 1965 when possibly 20% of all cars on the road are compacts, the consumption will be down about 6.5% below what it would be under the standard-car days.

Although compacts will cut into the increase in fuel consumption, the motoring public will still require more gasoline in the future for two reasons: The car population will increase and fuel economy will be reduced due to an increase in traffic congestion.

3. Octane Requirements

Detroit's whole philosophy behind the compacts is to switch the emphasis from power to economy. This will naturally mean less octanes will be required to fuel the compacts.

Following through with this thinking, Detroit has designed more cars for regular-grade specifications in 1960. Seventy-two per cent of the 1960 model cars specify regular. This compares to 65% in 1959 and 49% in 1958. On the other side of the ledger, only 28% of the new cars in '60 will require premium compared with 35% in 1959 and 51% in 1958.

All the introductory compacts specify regular. The gasoline requirements are higher than present six-cylinder cars, but lower than some of the regular-grade V-8's.

Octane requirements for the compacts will probably rise as Detroit gets more experience with the new cars. The first models have engines designed with compression ratios which get the highest efficiency from present regular-grade gasoline. Compression ratios on the compacts will probably in-

crease, particularly if regular-grade gasoline quality is improved over the present 90 Research octane average on the West and Gulf Coasts.

The pressure is still on refiners to turn out higher octane premiums, but it has been supressed considerably by the compacts. Compression ratios on some '60 models were raised, which will mean a higher octane requirement, but some others were cut from premium to regular.

It is predicted that on a trace-knock basis 40% of the 1960 models designed for regular fuel are satisfied with the weighted national average RON regular available in February. And about 70% of the premium-grade '60 models will be satisfied with the weighted national average premium.

Trace-knock requirement is the most critical requirement for a car. It pinpoints knock at its inception. Light-knock requirement is less critical but probably corresponds more closely to the requirement as might be recognized by the motorist.

4. Performance

Everything points to the compact being more efficient than the foreign car. Part of the efficiency is due to the compact's higher compression ratio.

The six-cylinder engines used in the compacts have about two-thirds the displacement and horsepower of the standard six cylinders (OGJ, Dec. 7, p. 80). The four-cylinder engines used in the foreign cars are only one-quarter as large.

This gives the compact about the same horsepower-to-weight ratio and acceleration ability as the conventional sixes. The foreign cars fall short on acceleration ability. When fuel-economy is related to weight and performance, the compacts are more efficient than the foreign cars.

Just how big the impact of the compacts will be on the U. S. car market hinges on one big question—will the U. S. public accept and buy what is offered.

Many close to the situation say the public will accept compacts, but they can't agree on just where compacts will fit into the market. They don't know whether the compact sales will cut into the standard-size market, the foreign-car market, or the high-priced car market.

But there seems little doubt that the high-horsepower, high-compression ratio factor that has been riding high in Detroit for several years will have to move over. Economy is in the driver's seat this year, and compacts by the million will hit the highways in 1960.

Revolutionary Rig May

• Houston company hopes to cut drilling costs with new drilling technique which features concentric drill string and reserve circulation.

Ed McGhee
Drilling Editor

FIRST FIELD TRIALS are under way on an original approach to some of rotary drilling's oldest problems.

Strato-Drilling, Inc., a Houston firm, is making hole with a new rig which features some revolutionary departures from present drilling methods. Among other things, Strato-Drilling is using reverse circulation, is pumping the drilling fluid through a concentric drill string, is using only core bits, and is continuously circulating cores to the surface.

As a result of this new approach to drilling, Strato-Drilling hopes to achieve these advantages:

... **Reduce the number** of round trips because of long diamond-bit life.

... **Operate satisfactorily** with extremely low horsepower mud pumps.

... **Cut rig costs** as a result of the first two factors.

... **Prolong diamond core-bit** life because the bit need not be lifted from bottom and there is no opportunity for junk to get on the bottom of the hole.

... **Obtain a continuous** core record of every foot of hole drilled.

... **Drill deeper with air** than would otherwise be possible.

... **Reduce mud expense** and hole trouble because there is no mud flow between the outside of the drill string and the walls of the hole.

The company, using a rig designed especially for this type of drilling, has drilled 1,800 ft. of hole in Shackelford County, Texas, and recovered 1,800 ft. of core. Plans are to move into the High Island area of Galveston County, Texas, immediately to start a series of sulfur-recovery tests.

Strato-Drilling is a new company formed especially to exploit the unique reverse-circulation idea. President of the company is Howard Rhodes, a long-time oil-field supply-and-manufacturing-company executive of Houston. Patents on the method are held by Homer Henderson, chief engineer of the concern. Henderson is an independent operator and consultant and was formerly a geophysical-company executive at San Angelo, Tex.

Concentric pipe is key . . . Henderson says that his interest in the reverse-circulation system was born in earlier attempts to get longer life from diamond core bits.

A big problem with such bits has always been junk in the hole. The bits must be lifted from the bottom each time a new single of pipe is added to the string in conventional rotary coring. And, at this time, any junk in the hole can fall to bottom where it quickly ruins the bit after rotation is resumed.

Moreover, when the core bit is lifted from bottom, there is an excellent chance that the core will jam in the barrel and make further penetration impossible.

An obvious solution to the problem was the power swivel. An old principle, the power swivel needs no kelly joint; thus, new singles can be added to the string without raising the bit.

Still, the footage drilled could be no more than the capacity of the core barrel. Wire-line core barrels are a partial answer to this problem but did not seem to be acceptable for continuous top-to-bottom work.

Then, Henderson hit upon the idea of using reverse circulation to pump the core to the surface as it is cut.

Simple reverse circulation, however, isn't good enough. The high mud pressures, if put on the sides of the open hole, would often cause lost circulation.

It appeared that a successful reverse-circulation system would hinge on developing a new drill string. It would be necessary not only to circulate down but back up as well.

Henderson's solution is concentric pipe—a large-diameter string with a smaller string welded inside. Circulation is down the annulus between the strings and back up the inner bore. Size of annulus and inner bore are such that pressure loss down the hole approximately equals that coming up.

The two-conductor pipe, of course, can be designed to break down into singles of any convenient length. When two joints are made up together, the outside string seals together with a conventional threaded, shouldering connection. Inner string seals by means of a bayonet connection using an "O" ring.

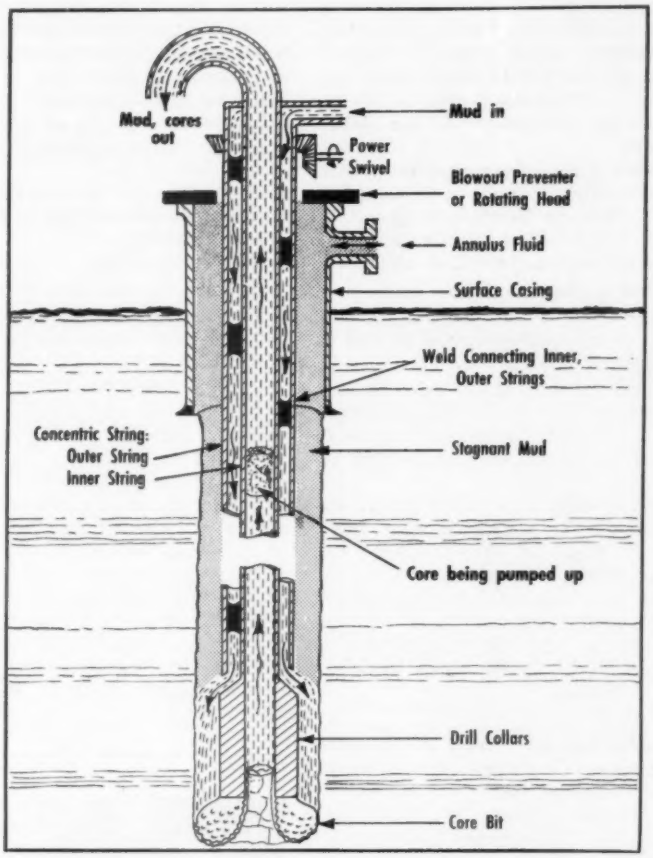
Thus, the outer string carries the entire load of pipe weight and rotat-

Solve Some Old Drilling Problems

How Strato-Drilling's New Rig Works

Features of the new rig:

- REVERSE CIRCULATION is used to reduce the volume of mud needed to keep the hole clean.
- CONCENTRIC DRILL STRING keeps pump pressure off the formation. Circulation is down the annulus between the strings and back up the inner bore.
- CORE BITS are used exclusively, mostly the diamond type.
- SYSTEM ROTATES with a power swivel so that bit doesn't have to be lifted from the bottom to make connections.
- CORES are circulated continuously to the surface.



O&GJ

ion. If there is a lengthening or shortening in the outer string, the inner string compensates for this by sliding in the bayonet "O" ring seal.

Low horsepower rig . . . Because Strato-Drill expects that bit life will be long and round trips few, the company's pilot model rig is built to pull only singles. The engine driving the rig's drawworks has only 165 hp. and the electric motor driving the power swivel is only 20-hp. The largest rig pump yet needed was only 4 in. by 6 in.

The rig does not have a conventional traveling block. Rather, the power swivel is mounted on a carriage that rides up and down the tubular legs of the mast. Instead of the usual single fluid connection to a swivel, Strato-Drilling's rig must have two. One fluid connection is a conventional rotary hose carrying the high-pressure input mud. The other connection is a curved tubular conductor which carries return mud and the cores circulated out of the hole. This latter conductor extends above the derrick and curves down to the shale shaker.

Test work thus far has been done with 4¾-in. bits, some diamond and some bladed. Core diameter is 2-in. The present rig can handle the concentric pipe to about 3,500 ft. The principle could probably be applied to rigs of greater capacity.

Basically exploration tool . . . Strato-Drilling sees its new drilling technique primarily as an exploration tool. The backers expect that such a low-cost continuous-coring method would find a big place in searching shallow areas for stratagraphic traps.

The cores (virtually 100% recovery is expected) will, of course, give conventional information on formation type and thickness, porosity, permeability, and fluid content. In addition, Strato-Drilling points to the availability of such information as presence of reef fossil, direct indication of formation dip, and possible indication of formation strike.

The company plans to use air as the drilling fluid wherever possible, expecting that greater volumes of formation water might be handled than with conventional methods but without excessive air pressure.

Where it is necessary to use mud, the program may be different from that with conventional methods. Since mud in the annulus between hole and pipe does not circulate, such mud could be treated heavily (although rather cheaply) to inhibit formation hydration and sloughing.

U.S. Coal Lobby Fighting Canadian Gas

• American mine interests will join provincial utilities in opposing gas exports at hearing before Energy Board.

FIREWORKS could easily develop January 5 when Canada's National Energy Board holds hearings on applications from four major companies to export natural gas to the United States.

Only three serious opponents to the export applications have developed so far. They are Northern Ontario Natural Gas Co., Ltd., the Saskatchewan Power Corp., and the U. S. coal lobby.

But a total of 13 intervenors have asked to be heard, including the City of Calgary which wants to be sure its supply of gas is protected.

Tone of the Calgary brief also has prompted the big Canadian Petroleum Association to protest and announce it may intervene on behalf of the exporters.

Four companies asking export permits are Trans-Canada Pipe Lines, Ltd., Westcoast Transmission Co., Ltd., Alberta & Southern Gas Co., Ltd., and Canadian-Montana Pipeline Co., Ltd. They have asked to export a total of 867 million cubic feet of gas daily at various points along the U. S. border.

Native foes . . . Most of the intervenors are interested only in individual aspects of the export question.

Northern Ontario Natural Gas asked outright rejection of Trans-Canada Pipe Lines' application to export gas from its trunk line near Winnipeg to the border of Emerson, Man.

Northern Ontario's two-volume brief said the interests of its consumers in 60 communities in northern Ontario could not be protected if Trans-Canada is allowed to export 204,000 M.c.f. of gas daily.

The brief said it cannot be assumed that Trans-Canada would be able to meet its Canadian commitments and export contracts. It added greater price protection is required to guarantee consumers fair and reasonable prices, and support development of Canadian industry.

The Saskatchewan Power Corp., although not opposed apparently to the principle of gas export, urged caution. It expressed fear that gas reserves will not be sufficient to meet Canadian demand.

The Saskatchewan utility said federal acquisition, relieving oil and gas companies of the burden of holding gas reserves for long periods while waiting for the domestic market to expand, "would provide incentive to oil and gas exploration."

It also asked that prior rights to Canadian natural gas be granted to Canadian utility companies.

Coal's position . . . U. S. coal interests claimed their concern was in the price of the exported gas which will be sold in competition with U. S. coal.

Included in the coal group are United Mine Workers of America, the National Coal Association, the Chesapeake & Ohio Railroad, and the Mid-West Coal Producers Institute.

Although not opposed to export in principle, the City of Calgary asked the board not to approve export without first insuring a sufficient supply of gas for the city's needs. Objections also were raised to the type of contracts signed between producers and transmission companies containing escalator and renegotiation clauses.

These clauses, said the city's brief, made it impossible to establish a fixed price for the gas during the lifetime of the contracts, most of which run for 25 years.

Others . . . British Columbia Electric Co., Ltd., said it is not opposed to export so long as Peace River supplies, upon which it is dependent, are not involved.

Crow's Nest Pass Coal Co. is opposing export because one of the pipelines involved will run across property which it says may be developed as a coal mine.

Several organizations expressed no opinion but reserved the right to make submissions later if they feel their interests become involved. Included were the Vancouver Board of Trade, the U. S. National Coal Association, and the Canadian Petroleum Association.

The CPA made it known that it was "disturbed by the tone of the brief" from Calgary officials. The Calgary city council authorized the brief on the city's behalf, and oil industry spokesmen said they feel it might harm prospects of gas exports.

Oil officials in Calgary declared there are ample reserves for Alberta consumers and the price they pay for gas will depend to a large extent on volume and the load factor. Any price increases to consumers would be more than offset by increased economic activity in the Calgary region. Most of the city's rapid economic growth is due to oil and gas.

watching WASHINGTON

Clyde La Motte

• Gulf readies arguments on quotas . . .

THE BATTLE shaping up over quotas for product imports is likely to be a hot one.

Gulf Oil Corp. is planning a vigorous attack, particularly on the method used by the Oil Imports Administration to determine residual fuel oil quotas.

Gulf's basic argument is that the use of 1957 product import levels as the sole yardstick for determining current quotas is unrealistic and unfair because it does not give consideration to a firm's domestic markets nor its domestic refining capacity.

For instance, Gulf says it had 8.9% of the total residual fuel oil sales in District 1-4 in 1957 and 7.6% in 1958—yet it is getting a quota of only 0.6%.

Furthermore, Gulf had 7.4% of the refining capacity in those districts in 1957 and 7.1% in 1958.

Yet, while it is getting only a sliver of resid quotas, three other companies which have only 19.6% of the

Lone Hurdle Left for Gas Pipeline Merger

• FPC rules El Paso Natural-Pacific Northwest consolidation will be in public interest. Companies now must win federal antimerger suit.

THE FEDERAL Power Commission has approved the merger of Pacific Northwest Pipeline Corp. and El Paso Natural Gas Co.

The FPC action leaves only one final hurdle to be cleared: Disposition of an antimerger suit filed by the Department of Justice.

That suit is in a U. S. district court in Utah, where a judge had delayed action pending a decision on the merger by the FPC.

The companies are now expected to ask the court to dismiss the case, although the Justice Department has indicated it plans to continue to push the suit.

The FPC, in making its ruling, agreed with an earlier opinion by one of its examiners that the merger was in the public interest. It will result in improved gas supply and greater utilization of gas reserves, a financially stronger gas supplier, expanded and improved gas service, and lower rates.

The commission said the merger also will result in a fully unified pipeline system from West Texas to Canada having many sources of supply to serve markets and "to benefit all consumers."

It noted that the merger will enable El Paso, which now has a greater dependence upon residue supplies than any other natural-gas company, to reduce its reliance upon "the vagaries" of oil production.

Concerning the antitrust problem, the FPC said it does not have the authority to determine whether any given transaction violates the Clayton Act, but said it did consider the bearing of antitrust laws on public convenience and necessity situations.

It agreed with its examiner that competition would not be greatly lessened by the merger and that sufficient competition would still exist with other companies for both supplies and markets.

The merger combines El Paso's facilities, serving markets in the Southwest and California, with Pacific's system, which extends from New Mexico to the U. S.-Canadian border.

Chemical, Textile Firms to Merge

TEXAS BUTADIENE & Chemical Corp. will merge with Industrial Rayon Corp. under a stock issuance plan to be approved by Industrial Rayon stockholders.

John Fennebresque, president of Texas Butadiene, will become president and chief executive officer of the merged company, and Hayden B. Kline, president of Industrial Rayon, will become chairman of the board.

Industrial Rayon, a major producer of tire cord and other textile fibers, will acquire Texas Butadiene by issuing 1,675,000 shares of Industrial Rayon common stock. The company now has 1,851,225 shares outstanding.

Texas Butadiene will retain its corporate name as an Industrial Rayon division. The company has a petrochemical plant near Houston, owns a 30% interest in a synthetic-rubber plant now under construction near Marseilles, France, and will build a petrochemical complex in Santa Cruz province, Argentina.

Principal stockholders in Texas Butadiene are Godfrey L. Cabot, Inc., Boston, and Carl M. Rhoades & Co., Inc., and Associates, New York.

Industrial Rayon stockholders will vote on the proposal early in 1960.

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refining capacity in Districts 1-4 have allocations totaling 46% of resid import quotas.

Gulf argues, too, that the present plan provides no flexibility with which to meet special problems and conditions of an indivdual company.

It points out that, in its own case, it had planned refinery expansion in Venezuela before the control system was put into effect. A vital part of the expansion plan was an increase of residual fuel exports from Venezuela to the U. S. to meet growing demands.

Now Gulf finds itself with a shortage of residual fuel in the U. S. and an excess of 25,000 bbl. daily of resid in Venezuela.

It claims that it is now paying from 20 cents to 30 cents a barrel more for domestic residual than it is getting when it sells that resid.

It claims, too, that it would be equally uneconomical for it to increase the residual production in its U. S. refineries due to the high cost of manufacturing and transportation.

Gulf says it has contracted to supply approximately 100,000 bbl. daily of residual in Districts 1-4 during 1960. Since it has an allocation of only 2,504 bbl. daily, it foresees a shortage of at least 32,000 bbl. daily unless the OIA increases its present allotment to 35,000 bbl. daily.

In arguing for a switch in the method used to determine resid quotas, Gulf insists that the OIA started off wrong by limiting each company to the amount it imported in 1957.

Gulf says the original presidential proclamation didn't call for such an approach. Rather, the proclamation specified that regulation of product imports, including residual, should provide fair and equitable distribution of such products among those who were importers during 1957.

Gulf interprets this to mean that the President's aim was to keep the over-all total—not the individual company total—to the 1957 level.

This, in Gulf's view, would enable the OIA to provide fair and equitable quotas based on realistic needs rather than quotas based simply on who hauled in how much during 1957.

• Socony, others, are unhappy, too . . .

Among other companies that have already filed notice of appeal, Socony Mobil uses somewhat the same approach as Gulf. It, too, made commitments in Venezuela before the control program was adopted and now is in a squeeze, particularly so with a new refinery unit due to go on stream in Venezuela in March.

Socony also uses this argument: Its crude-oil quota was cut sharply, partially to help make room for "newcomers" to the crude-import picture.

At the same time, virtually no room is being made for Socony in the product-import picture even though it has strong reason for being in that picture.

In other words, Socony figures it is getting the rough end of the stick in both cases.

GEOLOGISTS AT WORK . . . in the field . . . and in the office.

How Geologists Feel About Registration

● Geologists are sharply split over question of registration law. Those for it claim it would improve their professional standing. Others contend it would be opening the door for government control.

Merle F. Blakely
District Editor

THE NATION'S 30,000 geologists are violently disagreeing these days on one big question: Will a registration law give them new status or help cure ills of the profession?

The profession is yet nowhere near an answer.

But the discussion swirling around the issue has created three different schools of thought:

. . . **Advocates** of strict licensing. These favor registration or some form of legal policing, establishing higher academic standards or experience requirements, and creating an authority to purge the profession of those unqualified.

. . . **Opponents** of licensing. These warn such a step would persecute minorities, would be a step toward socialization, and would invite government control.

. . . **Advocates of the status quo.** This group feels there's no need for legal steps because existing geological societies can adequately regulate members' behavior and qualifications.

Why the fuss? . . . The problem stems from the fact that today anyone can call himself a geologist.

There's no legal authority to challenge a person's right to call himself a geologist. No requirements exist for professional training or educational background.

Result is that geologists generally don't enjoy a professional standing—it's often too difficult to separate the charlatan from the qualified practitioner.

On occasion, courts have held geologists in low esteem as expert witnesses.

The reaction . . . Many geologists have been startled by these indignities.

A growing number have felt the answer lies in a registration law similar to those which have raised the professional standards of doctors, lawyers, engineers, and architects.

These geologists argue some authority is needed to weed out the phonies who fleece the public and ruin consulting jobs and fees for competent geologists.

Lacking this authority, the geological profession is being weakened because its members are at a disadvantage when testifying before congressional committees, state boards, commissions, and courts.

The profession also is beginning to lose its identity. Too many members are becoming licensed engineers first in order to give status to their geological opinions.

The advocates of registration also feel such an act would stimulate more students to prepare for geology. It would provide the vehicle to enforce a code of ethics and also allow nationally uniform standards which would permit reciprocal interchange between states.

Most proposals for registration envision state geology boards created to issue licenses and ride herd on activities of members in the profession.

The other side . . . Many other leading geologists vehemently maintain that registration won't cure the ailments afflicting the profession.

They oppose state licensing because they claim it is an invitation for government control. It would open the door for politicians to invade the affairs of geologists.

These geologists also argue that:

. . . **Uniformity** wouldn't be assured by registration.

Different rules and regulations in different states actually would hamper a geologist in his practice.

. . . **The phonies** still would exist.

Should Geologists Be Licensed?

YES, because . . .

- Many phonies in the profession need to be eliminated. They fleece the public, ruin consulting jobs and fees for competent geologists.
- Professional standing for geologists would be enhanced. Geology is fast losing its identity as a profession. Many geologists have been forced to qualify as engineers to accept certain types of work or appear before groups where expert testimony or opinion is required.
- Code of ethics, uniform national standards could be enforced much easier, thus upgrading standing of geologists.
- Interest of students in a career in geology would be stimulated.

NO, because . . .

- Politicians would invade affairs of geologists, opening up a whole train of possible governmental interferences.
- Phonies would not be eliminated—they would only go underground and hide behind some registered geologist for a fee.
- Registrations would not be uniform in all states and this would hamper geologists practicing throughout the oil region.
- There's no pressing need for registration. The nation's welfare or health is not at stake. Some geologists just want registration to gain more job security, to charge more fees or reduce the number of geologists practicing in the field.

They would just go underground or hide behind some registered geologist for a small fee.

. . . **Pressing need** for registration doesn't exist.

One prominent geologist bluntly charges the clamor for registration stems from the present slack state of business. There's an oversupply of geologists growing from the unusual demand of postwar years. He warns, however, that arbitrary legal measures to tighten up the profession now probably would bring greater troubles in the future.

Another argument against registration is this: A legal need for such an act is difficult to establish.

Work of the geologist doesn't affect the public health and welfare to the same extent as the decisions of doctors, engineers, lawyers, or other professions.

. . . **Mediocrity** would be the chief result.

Some geologists have the impression that a registration law would offer more job security and allow them to charge higher fees. This leans toward socialism, opponents of registration argue, and places a premium on mediocrity.

Substantial opposition to the state registration is found among college faculty members. They claim state laws would give a "political group" too much authority to decide if a man is or is not capable of serving as a geologist.

The teachers also are concerned that such laws might lower educational standards.

Hunting a solution . . . At least four professional groups have committees studying the problem. They are:

. . . **American Association** of Petroleum Geologists with John Ware of Oklahoma City as chairman.

. . . **American Geological Institute** with B. W. Beebe, Boulder, Colo., as chairman.

. . . **Abilene Geological Society** with Dr. Frank Conselman as chairman.

. . . **Southwestern Federation of** Geological Societies with Roy H. Guess, San Antonio, Tex., as chairman.

The AAPG is proceeding cautiously. Its 15,600 membership is split on the issue. Both the advocates and opponents of registration are vocal. There seems no middle ground.

Chairman Beebe's AGI committee is making a painstaking study. Detailed reports of the acceptance of geologic practices have been made in 38 states and 5 provinces. This group expects to come up with specific recommendations.

It has 40 members representing all branches of the profession. Beebe is a past vice-president of the AAPG and recently chairman of its distinguished lecture committee.

The Beebe study committee said it wasn't constituted to force registration, licensing, or accreditation on the profession. Its report states:

"The situation at present is such that any individual, no matter what his training or background, can call himself a geoscientist.

"There is a strong feeling that if we do not investigate and rectify some of our intraprofessional situations, state legislative and regulatory bodies may force unfavorable regulation.

"Individual political entities or organizations of geoscientists acting without proper guidance may well cause a chaotic situation. It would be even more tragic to have regulation of our profession under engineering laws."

The Abilene, Tex., study deals in specifics. Of 300 questionnaires sent geologists in the Southwest, 121 were returned. Registration was approved by 91, opposed by 13, with 17 undecided.

Dr. Conselman said chief objections of those opposing were "dislike of regimentation, dislike of 'unions,' and fear of discrimination or unfairness."

Dr. Conselman's committee, however, reported it felt neither regimentation nor unionism possibilities have any substance. It added: "Possible discrimination may be eliminated by a 'grandfather' clause in any statutory definition of qualifications."

The whole controversy is being laid on the line by the Southwestern federation. Members of local societies are casting votes on the issue.

Geologists are being asked their opinions on registration, why they approve or disapprove, what should be the qualifications for registration, what subjects should be covered in any written exams, and under what circumstances should a registration be revoked.

The results of the questionnaire will be tabulated and federation members advised.

Straws in the wind . . . Official recognition of the need for raising geological standards came in action by the AAPG at its annual meeting in April.

The association stiffened requirements for AAPG junior membership. Qualifications now: Applicant must be accepted as candidate for at least a master's degree in a reputable college and must be engaged in petroleum geology or geological research.

The candidate may substitute actual experience in petroleum geology, exploration, or research for the scholastic requirements.

Previously, any person was eligible for junior membership who had 30 semester hours of geological study or the equivalent training and was engaged in studying, teaching, or geological work.

The AAPG, by raising standards of its junior members, is strengthening the qualifications of about one-fourth of its membership. There are now 3,848 junior AAPG members and 10,560 active members.

Another, even more stringent, recommendation aimed at upgrading geological training has been made by Maury M. Travis, a Denver geologist. He has recommended to the Stanford University school of mineral sciences that a bachelor's degree in geology be abolished in favor of graduate study only. Travis is a 1926 Stanford graduate.

"The bold proposal to abolish outright the bachelor's degree in geology and any other technology can eliminate the many headaches now plaguing the profession," Travis told the Stanford administrators. He proposes that a bachelor's degree in arts and sciences be a prerequisite to a master's degree in geology or the other sciences.

The road ahead . . . The poll-taking, discussions, and thinking now taking place may be only the forerunner of sharp debates and round tables to come before the issue is settled.

For the moment, however, the commotion has one meaning: A strong reform movement to raise standards among the world's earth specialists is gaining a full head of steam.

RADIUM SULFATE was inserted by Esso Standard into "pig" to clean new lube-oil line at Bayonne.

WHEN IT STUCK, Esso adapted a pipe-thickness instrument using radiation detection to find it.

Radioactive Isotopes, Still

RADIOISOTOPES are saving the oil industry millions of dollars annually. The sum will increase greatly as present methods of utilizing isotopes becomes more common and as new methods of using them are found.

Use of radioisotopes by more than 50 oil companies has been studied. It shows that these companies are saving an average of more than $1 million per month as a result. Here are the results in brief:

. . . **Thirty-three refiners** reported savings of $11,671,158 in a 12-month period.

. . . **Twenty producing companies** reported savings of $820,350 in the same period.

Estimated annual savings on individual projects ranged up to $500,000 in producing and to $598,000 in refining.

Of all industries using radioisotopes, petroleum refining is, by far, the biggest beneficiary. This was made clear in the census, conducted by the National Industrial Conference Board for the Office of Isotope Development of the Atomic Energy Commission.

Petroleum refining, says the report, accounted for "more than a fourth of the $39 million worth of savings uncovered. Thirty-five companies in refining and related business were using radioisotopes. Thirty-three of these supplied usable savings information.

"Nearly half of the industry's $11,671,158 savings were derived from reductions in research costs or from dollar benefits that flowed directly from research findings. Almost as much was saved by using radioisotope level gages. These proved particularly helpful in controlling foaming and coking operations, producing some dramatic savings in downtime and maintenance costs."

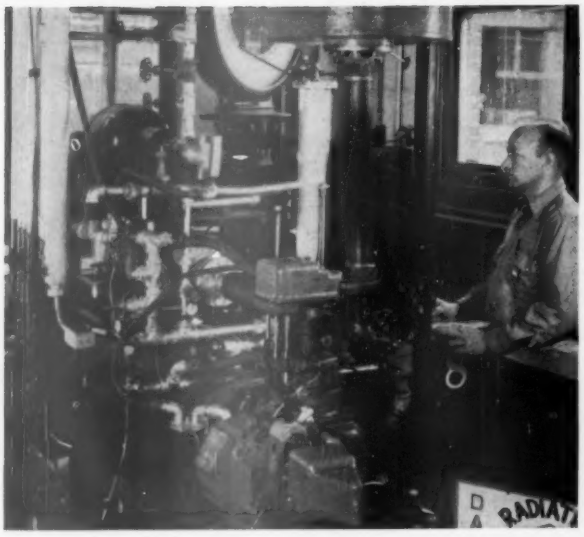
The 33 refining companies invested $295,000 in isotope facilities and equipment. Thus, the savings they reported amounted to 40 times the investment they made.

More than $5 million of refining's savings came in research operations and more than $4 million in level controls and density measurements. Other principal areas of savings were in thickness measurements and process equipment inspection.

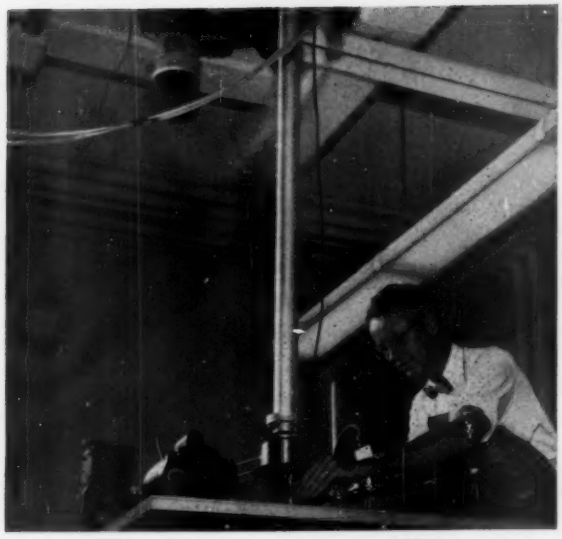
Here are some of the ways companies use isotopes and how much they save in doing so:

1. Research and Testing

. . . **Wear Testing.** The part to be tested, possibly a piston ring, is put into a nuclear reactor where it becomes radioactive. It is then installed in an engine. As the engine operates, radioactive wear particles contaminate the crankcase oil. This oil is pumped continuously through a radiation recording device. The device determines the amount of radioactive material present, thus accurately measuring the wear.



PISTON-RING WEAR is measured quickly with isotopes—and at a big saving—by Socony Mobil at Paulsboro. A radioactive ring is inserted in an engine. Object: Better lube oils.



NEW PROCESSES could come from research such as this at Paulsboro. A radiation chemist prepares to expose a sample to beta radiation, which will change its basic structure.

in Infancy, Are Saving Big Money

Annual savings with this method ranged from $8,000 to $598,000 and totaled more than $2.5 million. One company found radioactive wear tests took only 6 hours against 500 hours for a conventional test. It has estimated its yearly savings at $400,000. Another reported wear-test savings of $234.30 per test.

. . . **Cutting tools.** The same principle was applied to measuring the wear in machining tools. The amount of radio-activity found in the cutting oils or on the machine chips determined the rate of wear on the tool.

One refiner reported a saving of $10,000, another $151,000, and a third $301,000. An important benefit of the wear test is that it permits a study of the rates and mechanics of wear as it progresses, pointing the way toward improved lubricants.

. . . **Films and deposits.** The surface of a plug is made radioactive and the plug is inserted in the part of the engine to be tested. By measuring the radioactivity of the plug surface before and after formation of the deposit, the thickness of the deposit can be measured.

After the addition of radioisotopes to fuels or lubricants, the location and extent of deposits any where in an engine can be determined by going over it with a detection device.

This is much faster and more sensitive than the conventional method of operating the engine for long periods of time to build up measureable deposits, disassembling the engine, scraping off the deposits and weighing them.

Few refiners found this measureable in dollars and cents but all found it superior in that it produces information unobtainable by older methods.

. . . **Quality-control tests.** Sulfur content can be determined after exposing a hydrocarbon sample to radiation. The amount of radiation absorbed by the sample is related to its sulfur content. It can be accurately measured by a detecting instrument.

Several companies reported annual savings of from $3,000 to $8,000 with this method. One said that each conventional test cost it $40 while a radioisotope determination cost only $5.

Four companies use radioisotopes for hydrogen-carbon ratio determinations. One performed 350 such tests and estimated it cost $5 against $40 per test using conventional methods. Another said it saved 100 minutes of laboratory time per test and saved $24,000 annually. A third began to do its own analyses at $10 per sample against $25 paid to a testing laboratory.

2. Refining

The 33 refiners made almost 50 different research studies aimed at improving refinery operations by tracing isotopes through involved steps.

Such tracer techniques have enabled some companies to avoid expensive shutdowns for the visual examinations they normally make.

One midwestern refinery used the tracer technique to solve foaming problems in a phenol plant, an extraction unit, and a coking unit, and to run down trouble in a fractionating tower. It claimed savings of from $14,000 to $600,000 on these projects with a total saving of more than $1 million. It also said that in three of the four instances, capacity was increased from 1% to 30%.

Another company, testing for leaks in heat exchangers, reported savings of $75,000. One claimed a saving of $40,000 in the operation of a fluid coking unit and a 2% gain in efficiency. A fourth reported savings of $240,000 in reduced catalyst losses.

Still another said it has found a way to treat catalyst beads to prolong their life. When applied commercially, it should have "considerable economic benefits," it reported.

. . . **Inspection of processing** equipment. Four companies reported savings of more than $16,000 per year in decreased labor and material costs by using radioisotope radiography. One company made 100-300 radiographs of materials from ½ to 3 inches thick and saved $700 in labor costs alone. It also found that improvements in safety and employe relations were important benefits.

. . . **Measuring levels.** Radioisotopes

are being used extensively as level gages. It is claimed that they are "so superior there is no real comparison between radioisotope gage levels and former methods." They have helped to increase productivity and to effect substantial labor savings.

One company credited a saving of $2 million annually to radioisotope gages. It found it was possible to double the length of runs on a thermal unit before shutting down to remove coke.

Another credited such gaging with the elimination of an annual shutdown at a saving in labor, alone, of $10,000. Still another replaced a petcock gage on a coker with radioisotope gage and reported savings of $98,000 on each of two units because of fewer shutdowns and greater productivity.

. . . **Density Measurements.** Just one company reported savings as a result of density measurement of catalyst in a cracking unit. It claimed to have reduced catalyst losses and to have saved $300,000 per year. Another company, late in instituting radioisotope density measurements, finds it is "more accurate, gives more information and is faster to apply."

All density measurements with radioisotopes have not, however, been successful. One company tried this means for continuously measuring the specific gravity of an oil stream. It found that electronic interferences prevented trouble-free operation.

3. Production

Savings in producing operations have been much less than in refining, but several substantial achievements have been credited to the use of isotopes in producing.

The two principal uses have been in well logging and in water-flood operations. The biggest savings are credited to the latter.

One producer used radioisotopes to trace the path of water injected in a flood. The resultant profile provided the company with data that enabled it to increase the efficiency of the flood and reduce pumping costs. It said its annual savings were $500,000.

Another, using Iodine 131, was able to reduce residual oil in a secondary-recovery project from 40% to 20%. Iodine 131 is water soluble, loses its radioactivity rapidly enough to minimize hazards, and gives off highly energetic gamma rays that are readily detectable.

Gas was being diverted in another injection operation. The location of the leaks was determined by radioisotopes and an estimated $230,000 was saved in gas, pumping costs and miscellaneous operating expenses.

. . . **Oil well logging.** Artificial radioisotope logging is used rather widely but with little marked advantage over other methods. It is expected that artificial isotopes will gradually supplant natural isotopes since the former are much less expensive and present less of a health hazard.

While nine companies reported on the use of radioisotopes in well logging, only one said that it has been able to locate a producing formation that would not otherwise have been found.

. . . **Well completions** and trouble shooting. Radioisotopes are being used to trace unwanted flow channels, to locate cement behind casing, to determine where and how drilling fluid is being lost, to control acidizing and fracturing operations and in other well completion and trouble-shooting operations.

Radioisotopes are preferred to chemical tracers: They are more sensitive, smaller amounts can be used, they have more specificity, they can be chemically identical with the material being traced, they can be identified rapidly, no complex chemical procedures are needed to recover them, and remote identification is possible.

One producer found that radioisotopes proved that injection water was going where "we wanted it to go." This positively eliminated a work-over job which might otherwise have been performed. The saving was estimated at $30,000.

. . . **Research.** Six producing and associated service firms are using radioisotopes in research. These included studies of the age of sedimentary materials, movement of materials in porous media and the development of devices for measuring density and for well logging.

Half of these companies report that there is no satisfactory alternate to radioisotopes. They find it impossible to measure their value but are confident that future tangible value will result.

One, for example, is trying to determine the absolute age of sedimentary material by radiocarbon dating techniques. Naturally radioactive carbon, present in such formations, loses its radioactivity at a constant rate. Thus it is possible to determine the age of materials containing radioactive carbon.

4. Pipelining

. . . **Leak detection.** Two companies, by tracing products through pipelines, found leaks. As a result, only a few lengths had to be dug up. One estimated its saving at $25,000; the other, $20,000.

. . . **Finding obstructions.** One firm used an isotope to locate a stuck scraper in a 9,000-ft. section of buried line. It estimated its saving at about $2,500.

. . . **Marking interfaces.** One pipeline adopted as routine the use of isotopes in the product stream to mark interfaces between product batches. It reported no dollar saving, but said the method simplified the dispatcher's job.

Another company used the same technique to separate tenders of crude oil. By more accurate segregation, it reduced the volume of crude downgraded by the refiners and resulted in an annual saving of $200,000.

Another pipeline firm figures it saved $20,000 a year by using radioisotope density gages to monitor the density of products passing through its line. The gages displaced four men who had gaged and recorded densities of the moving fluids.

This company and two other firms using the isotope density gages agreed that they have obtained cleaner operations and more accurate control of product pumping.

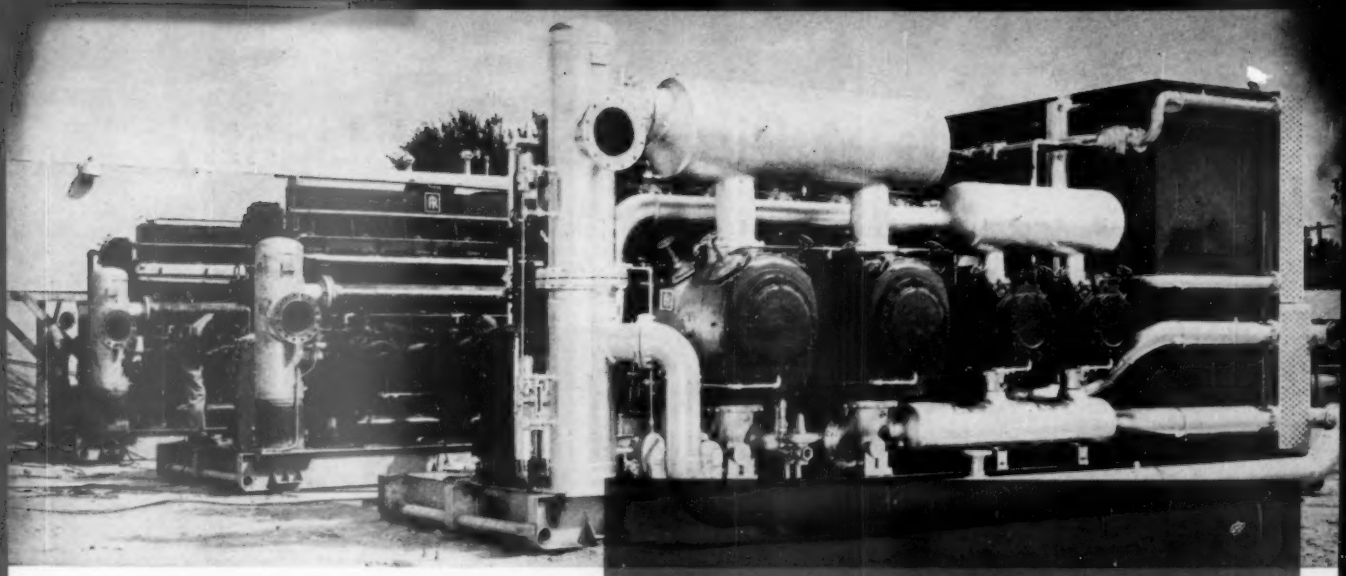
. . . **Checking corrosion.** A section of line is made radioactive and then inserted into a loop. Products are circulated and, in a few hours, withdrawn and tested. The amount of radiation indicates the rate of corrosion.

This was used to test a line designed to carry gilsonite in a slurry. The test showed that a fine layer of oxide would form inside the pipe and the abrasive action of the gilsonite would scrape it off. In normal use, the line would be eroded through in 2 years.

As a result, a deoxidizing unit was installed before the line went into operation. Had the study not been made, it would have been perhaps a year before the condition was discovered, and by this time the line would have been half eaten away. The company estimated its saving at $1 million.

. . . **Gas-line inspection.** One company is using isotopes to take the place of the X-ray generating machine for inspecting piping assemblies on compressors, experimental welds, and various other welds.

The company claims no direct savings from its additional $3,500 annual investment in equipment. But, it says, radioisotope inspection makes it possible to check welds in complex systems that could not have been examined by other methods. This, it says, tends to lessen the possibility of piping failure and possible serious injury to personnel and property.



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Rogers Slaps at Pipelines—But Lightly

• Attorney general's report on IOCC states the joint use of pipelines by major companies has "grave potential" for control of crude-oil markets.

IT APPEARS unlikely that the recent report by Atty. Gen. William P. Rogers on the Interstate Oil Compact Commission will have any major, far-reaching impact.

True, the report is somewhat critical of pipeline operations, and it expresses "curiosity" about the "rigidity" of crude-oil prices.

But there wasn't anything particularly new or different in the current findings. Actually, some of the earlier Justice Department reports had been even more critical of pipeline operations than this one.

Furthermore, the Justice Department report made no finding of illegal actions in pipeline operations. Nor did it contend that pipeline growth has failed to keep pace with expanding needs.

Finally, the attorney general made no concrete proposals aimed at changing or improving conditions affecting pipelines. The nearest he came was to suggest that Congress might want to investigate the subject and draft corrective legislation to any problems it might find.

Main criticism . . . The chief fault the attorney general found with current pipeline operations is that the pipelines constitute a market for crude oil and, therefore, the major companies controlling the pipelines have a powerful weapon in their hands.

This controlling power, Rogers reasons, is made even greater by the reciprocal use of pipelines "among the select group of integrated companies owning pipelines."

Rogers concludes that "cooperative use of pipelines has a grave potential for control of crude-oil markets."

He expresses concern, too, that the producer—particularly the small producer—usually has no choice of pipelines because "only one possible pipeline connection is usually available to a well and, considering its cost, is likely to endure for the life of the well."

Rogers also points out that in a period of oversupply some pipeline companies refuse connection to leases with existing connections and "reluctantly" grant connections where none exists.

Rogers does, however, detect several "favorable" developments in pipeline operations.

Atty. Gen. William Rogers
. . . criticism considered mild.

For one, "the growth of independent gathering and exchange does indicate that it is not necessary for a refinery to control directly either gathering or trunk line operation for its purposes."

And, he concedes that jointly owned lines, as well as the undivided interest lines operated by one company for several participants, "apparently serve shippers as well as those pipelines directly controlled by the shipper."

He cites the Buckeye Pipeline Co. as an example of the practicability of pipeline operation wholly independent of refinery control.

Prices "rigid" . . . Turning to crude-oil prices, Rogers argues that they have become "rigid" and apparently not very susceptible to changing market conditions.

Tracing the pattern of crude-oil prices, Rogers finds that in the pre-conservation days of oil production, there were violent fluctuations of both crude and products.

With the advent of conservation practices, prices became more stable, but still responded to upward and downward pressures up to the World War II freeze.

After the war, Rogers says, stability of crude prices became "rigidity."

"There were only upward revisions of price to levels out of line with the hard-won, antiinflationary stability of other raw material prices," Rogers reports.

Furthermore, according to the attorney general, "there is clear indication that the movement of crude prices was not at all times paralleled by that of product prices."

To report his argument that price "rigidity" has existed since World War II, Rogers points out that whereas there have been up-and-down fluctuations of basic raw materials, crude-oil prices have shown a different response.

"Significantly, between World War II and 1957, there was no downward response at all. Considering the general economic experience of these years, this rigidity is remarkable, especially since crude oil throughout the period was increasingly in oversupply."

Despite the criticisms, the attorney general's report for the most part reflects approval of the oil industry and the efforts of the Interstate Oil Compact Commission.

For one thing, he finds that sharp competition exists, particularly in production, refining, and retailing levels.

And, too, he agrees that the oil industry has made available an adequate supply of oil and oil products for both peacetime and emergency use.

PIPELINE

A price of 23 cents an M.c.f. for Hugoton field gas has been awarded to Hugoton Plains Gas & Oil Co., subsidiary of Crescent Petroleum Corp., by an arbitration board in Kansas City, Mo. Hugoton Plains now receives 10.5 cents an M.c.f. from Northern Natural Gas Co. The contract, requiring FPC approval, calls for the new price for a 6-year period starting January 1, 1960. Members of the arbitration board were Walter A. Huxman, Topeka, Kans., retired senior judge of the U. S. Court of Appeals, Tenth Circuit; Herman H. Kaveler, Tulsa, consulting petroleum engineer; and William R. Duff, Washington, D. C., attorney.

Three stations on the Standard Oil Co. (Ind.) products system are being

Pan Am Gets Go Ahead on West Texas Flood

- Railroad Commission approves 3,740-acre Three Bar Unit in Andrews County. Midland Farms request pending.

PAN AMERICAN Petroleum Corp. has received approval from the Texas Railroad Commission for one big West Texas water flood and is seeking a permit for a second one.

The commission has authorized water injection in the Devonian zone under the company's 3,470-acre Three Bar Unit in Three Bar (Devonian) field of Andrews County. Pending is Pan Am's request to flood the 4,800-ft. Grayburg pay under its 7,000-acre Midland Farm "AK" lease in Midland Farms field of Andrews County.

The Three Bar unit was formed in 1952. And about 25,000,000 cu. ft. of gas has been injected through three wells in a gas-injection program started that year with good results. Gas injection will be continued.

The Three Bar unit takes in 3,470 of the field's 5,400 productive acres and now has 27 wells making an average of 68 bbl. daily each. Cumulative production from the leases since the discovery in March 1945 to October 1 was 12,157,231 bbl.

Three Bar's 8,400-ft. Devonian pay is a dipping, strat-trap type reservoir producing under solution gas drive. Pan Am plans to inject water down dip and flood upstructure. It will use a closed system and inject water from the shallow Santa Rosa zone through three input wells—two of which will be drilled.

Initial input rate will be about 2,000 bbl. per well per day at a pressure of about 1,500 psi.

Pan Am's "AK" lease in Midland Farms takes in a little more than half of the field's 13,500 productive acres. The lease now has 149 wells producing an average of 25 bbl. of oil daily. It is in the intermediate stage of primary depletion.

Cumulative production from the solution-gas-type dolomite reservoir to October 1 was reported by Pan Am at 47,044,542 bbl.

FPC Gets El Paso's Favored-Nation Plan

THE PLAN of El Paso Natural Gas Co. to eliminate favored-nation clauses from its contracts with producers in the Permian basin is now in the hands of the Federal Power Commission.

The FPC has suspended the proposed rate increases involved. This, however, is routine action the commission takes in virtually all cases involving rate hikes. It simply means that it will not approve such increases until rate hearings are held.

There is little doubt that the FPC opposes favored-nation clauses generally. So the issue in the El Paso case will be whether the rate hikes proposed as a "substitute" for the favored-nation clauses are too high a price to pay for elimination of the clauses.

The price hikes proposed by El Paso to its suppliers would be as much as 5 cents to 6 cents per M.c.f., boosting them to 13½ cents to 17 cents, depending on pressure and quality (OGJ, Nov. 23, p. 41).

In turn, the suppliers would agree to drop the favored-nation clauses from their contracts with El Paso.

In making the proposal to its suppliers, El Paso specified that at least a majority of them would have to agree to the plan or El Paso would abandon it.

In December, El Paso announced that a majority of the producers had agreed, and the producers began filing their proposals with the FPC.

The FPC has estimated that the total impact of the renegotiated rate increases would be $22,820,000 annually if all producers in the Permian basin area renegotiate their contracts with El Paso.

BRIEFS...

expanded. Standard is installing 600 hp. at Granger, Ind., and Napoleon, Mich., both to be finished February 1, and 1,250 hp. at Girard, Mich., to be completed March 1. Contractor at Granger is B & G Construction Co., at Napoleon, North Construction Co., and at Girard, Easterday & Musser.

An experimental gas turbine compressor unit powered by a J-57 aircraft jet engine has been approved by the FPC for the Clementsville, Ky., station of Columbia Gulf Transmission Co. Cooper-Bessemer Corp. will provide the 10,500-hp. turbine and compressor without charge for the test period of 8,000 hours or 18 months. Cooper-Bessemer will contribute $1,025,000 of the total cost of $1,554,000 for the remotely controlled unit, reputed to cost only one-half as much as conventional turbine units. Cost of the experimental unit is $148 per horsepower.

Work has started on the 116-mile 34-in. pipeline being built in California by Pacific Lighting Gas Supply Co. to connect with the 1,809-mile Transwestern line at the Arizona-California border. The line will extend from Newberry to the border 7 miles north of Needles. At Newberry it will connect with a proposed 36-in. line planned by two affiliated companies to Los Angeles.

Also for Pipeliners...

IN THE NEWS: U. S. coal interests are among the intervenors who'll oppose Canadian natural-gas exports into the U. S. when the National Energy Board meets (p. 50) . . . Court antimerger suit is last hurdle for El Paso Natural-Pacific Northwest merger after the FPC gives its approval (p. 51) . . . Radioactive isotopes still are in their infancy, but they're saving the industry millions (p. 54) . . . Attorney General criticizes crude-oil pipeline operations in his report on Interstate Oil Compact Commission (p. 58)

PLUS THESE TECHNICAL REPORTS: Electric-reciprocating compressor-powered station (p. 73) . . . Lube tests reveal compressor-engine wear (p. 96).

SEPARATING Iran and Iraq is the Shatt-al-Arab, the waterway used to move products from Iran's Abadan refinery.

Two Middle East Oil Powers on Edge

MONTHS AGO in the pre-dawn hours one morning two minor units at the sprawling 415,000-bbl.-daily Abadan refinery exploded with sharp reports that tumbled half the Iranian population of the town from their beds.

The first thought in the minds of a good portion of the jittery 280,000 Iranians who live in the steamy, mudflat town was that the Iraqis had started firing on them. American and European staff at the big refinery were inclined to laugh off the incident as a joke, but even then things were tense.

Last week the border friction between the two volatile Middle East neighbors reached an almost fever pitch. The friction is being caused by a long-standing dispute over who has control of the narrow Shatt-al-Arab, which separates the two nations, both moslem, but one Arab and the other Persian. Iraq now controls the river.

Western diplomats offering to act as arbiters were inclined to discount any serious possibilities, but Shah Mohammed Riza Pahlevi of Iran interrupted his honeymoon to confer with his military aides.

Refinery at stake . . . The Iranians regard the whole question of control of the waterway so serious that they are now asking for bids from pipeline contractors for a whole new network of lines and terminals to take Abadan from under the Iraqi fist.

National Iranian Oil Co., the government oil agency, has already received at least three multimillion-dollar bids for pipeline or canal networks to move the Abadan shipping terminal to the head of the Persian Gulf and away from the Shatt-al-Arab.

All proposals so far received would be downright ruinous from an economic standpoint. Each would mean abandoning the entire Abadan terminal operation and moving the terminal miles to the southeast to what is clearly Iranian waters.

Last year about 850 tankers threaded their way up the Shatt-al-Arab to the Abadan terminal.

The waterway treaty . . . The Iranians have distrusted their Iraqi neighbors particularly since the bloody revolution which put Gen. Abdel Karim Kassem in power more than a year ago. But the dispute over the Shatt-al-Arab goes much further back.

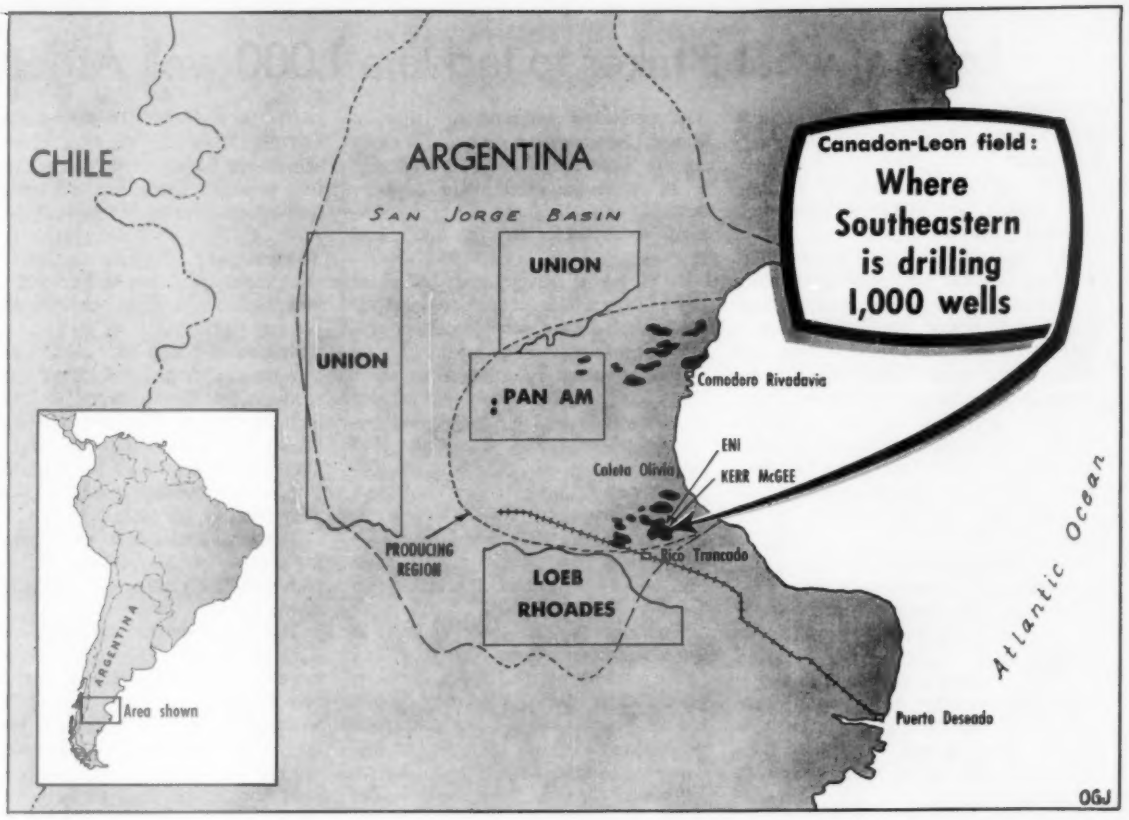
The waterway serves as the border between Iraq and Iran for more than 60 miles and is the only major gateway for either to the Persian Gulf. The southern extremities of Iraq are marshy mud flats. Iran has few deep-water facilities available for southern ports.

The Shatt-al-Arab is formed by the confluence of the Tigris and Euphrates rivers, both Iraqi rivers. Under a 1937 treaty Iraqi has sovereignty over the river to the low water mark on the Iranian bank.

The only exceptions to this sovereignty were the Abadan terminal area, about 3 miles in length and extending to midriver, and a smaller anchorage at Khorramshahr, 10 miles north of Abadan.

The Iraqis say the treaty was signed under duress and they want to control the river. The Iranians reply that at best the treaty was only an interim agreement and now they claim control to midriver for the entire length of the waterway.

Last week diplomatic circles were doing all that could be done to call a halt to further name calling and troop movements that might flare at any moment between the two countries. There was a great deal of private speculation that Premier Kassem in Baghdad might be creating a new border dispute to detract from his own internal troubles in Iraq.



Giant Argentine Program Launched

• Dallas contractor kicks off 1,000-well drilling program that will help make Argentina's Comodoro Rivadavia area one of Latin America's biggest producing regions. The program calls for 300 completions a year.

Robert J. Enright
District Editor

RIGS start making hole in Argentina's Comodore Rivadavia region this week, kicking off operations under perhaps the largest single drilling contract ever negotiated.

It marks the actual start of a tremendous project—drilling of 1,000 development wells by Southeastern Drilling Co. of Argentina, S. A., an affiliate of Southeastern Drilling Corp., Dallas.

Under the contract with the Argentine Government, Southeastern will drill the 1,000 wells in a 100,000-acre patch on the southern flank of the Comodoro Rivadavia producing area.

In return, the American contracting company will be paid more than $50,000,000.

At the height of the drilling program, which must be completed in 4 years, Southeastern will have 16 rigs working. Half of them will be drilling rigs, the other half completion rigs which will dig the surface holes and handle completion work.

All are new rigs purchased from Ideco, Inc., in a $10,000,000 deal announced last May. The drilling rigs, all rated at about 8,500 ft., are Ideco H-525's—six of them skid-mounted, the other two on wheels. The completion rigs are H-25 Rambler units.

The company's 4-year contract actually began last August 27 when the National Bank of Argentina activated the contract through endorsements and guarantees.

The Southeastern contract is one of three drilling contracts made for the immediate area. Just west of the Southeastern area, Kerr-McGee Oil Industries has a contract to drill 500 wells and Saipen, an affiliate of Ente Nazionale Idrocarburi, the Italian Government's oil agency, has a contract for 300 wells.

Fast start . . . Southeastern has wasted no time in getting drilling under way.

The company has moved at remarkable speed, considering the huge amount of equipment which must be moved inland and the fact that field and town-camp accommodations couldn't be set up until equipment reached the port of Deseado, Argentina, 2 weeks ago.

Southeastern is erecting a 500-man field camp in the center of the company's drilling zone of operations about 15 miles north of the little town of Pico Truncado. This is about 65 miles south of the town of Comodoro Rivadavia, location of the headquarters base of operations.

Equipment and supplies from the first of three shiploads of equipment moved inland 160 miles by rail from

Look at what it takes to tackle a 1,000-well Argentine

WHAT does it take to handle a 1,000-well drilling contract in a far-off land?

Officials of Southeastern Drilling Co., Dallas, are quick to agree that it takes plenty!

Already unloaded at Deseado, Argentina, are 11,400 tons of drilling equipment and supplies, motor transport, and camp facilities. Another ship to leave the Gulf Coast soon will carry more than 6,000 tons of the same. A third to carry eight more rigs probably will swell the total to almost 30,000 tons—and this doesn't include a stream of expendable items like bits, more drilling mud and additives, and cement that will flow steadily to the Comodoro Rivadavia area during the 4-year duration of the contract.

Initially, Southeastern is moving 1,200 tons of cement and 800 tons of drilling muds and chemicals to its drilling area.

Mute testimony to the company's plans to use a lot of cement is provided by the mixing facilities it is taking along. It will have three mixers — two of them huge 16-cu.-ft. models, the third a dwarfed 3½-cu.-ft. job.

But more staggering is the list of automotive and camp facilities the company needs to carry out its big program and move from the U. S.

The motorized equipment . . . For instance, Southeastern is taking along six big Autocar DC 9564 trucks with a 38,000-lb. rear-axle load capacity and 229-in. wheelbase. They're powered by 6-cylinder, 218-hp. GM diesel engines.

It is taking seven more of these trucks with 181-in. wheelbase and two giants with 295-in. wheelbase and 60,000-lb. rear-axle load capacity.

The company is toting along three D8 Caterpillar bulldozers—each with Hyster winch and gin poles and hydraulic dozer blades, one Caterpillar No. 12 road grader, two Butler 6,000-gal.-capacity fuel trailers, a Clark 10,000-lb.-capacity fork-lift truck, and two Model 1841 Ford tractors—one with a front loader, 12-ft. backhoe, and 18-in. bucket, the other with a 36-in. pier-hole drill.

The shipping lists also include: A 2-ton flat-body, dump-type utility truck with a 12,000-lb.-capacity winch; four 2-ton Chevrolet panel-body trucks; 16 ½-ton Chevrolet pickup trucks with tool boxes and two-way radios; five ¾-ton Chevrolet pickup trucks; canopy bodies (eight-man capacity) for four of the ¾-ton pickups; two six-cylinder Chevrolet automobiles; one Darby pole trailer with 20,000-lb. axle capacity; one Darby tandem lowboy trailer with 18,000-lb. axle capacity; and two 2-ton Chevrolet vehicles with school-bus bodies to transport Argentine nationals from the field camp to Comodoro.

The camps . . . Camp facilities and equipment to accommodate 500 men make an even longer and more impressive list.

The town camp at Comodoro is a complete community in itself. It includes an office building, 10 three-bedroom houses, and 12 two-bedroom houses for the 23 families that will live there, recreational facilities, RCA radio-control center and tower, and a great variety of other supplies.

The family houses are prefabricated for quick assembly and are sent complete with carpeting, water heaters, linens, etc.

The field camp will have seven steel warehouses. Three of them are large 50 by 102-ft. structures. Two are 50 by 100 ft., one 30 by 60 ft., and one 20 by 34 ft. There is a 40 by 88-ft. steel shop building.

Living quarters include: Three 48-man bunkhouses and 48 Porta-Kamp units (8 by 16 ft.) to house the Argentine work force; 10 three-man bunk houses; three four-man bunkhouses; and four toolpushers' quarters.

Deseado to Pico Truncado. They were transported the remaining distance to the field camp site by truck.

This first shipment includes four rigs (two drilling and two completion), motorized equipment, and camp materiel.

The second, now loading on the Gulf Coast, is taking four more rigs and more auxiliary equipment.

The third will haul the remaining eight rigs.

The drilling program . . . Southeastern is aiming, when drilling gets up a full head of steam, at completing about three wells a month per drilling rig. This amounts to about 300 wells a year.

Drilling conditions in the area are relatively good. Sediments are soft-to-medium hard and drill about like those in central Mississippi. Crooked-hole is no trouble. But some lost circulation has been encountered in formations just above the 4,700-ft. Miocene sand pay. For the most part mud weights are normal and so are the bottom-hole pressures.

Southeastern's plan of drilling action is simple and designed to drill the most wells in the shortest length of time.

The small rigs will drill the surface holes to about 150 ft., set 10¾-in. surface casing, and move off to other locations. The bigger rigs will move in, carry the hole to total depth of 4,700 ft., run 7-in. production string, cement, and move off. The completion rigs will return to complete the wells, run tubing, and put them on production.

The company goes on a day-work basis as soon as the production casing is set.

A Lane-Wells Co. affiliate, Petro-Tech, Argentina, is under subcontract to Southeastern for wire-line work. And Dowell holds a similar subcontract for cementing.

Southeastern will furnish cement, drilling mud, bits, spare parts, and other supplies. Yacimientos Petroliferos Fiscales, the Argentine government oil agency, will furnish the casing and tubing.

Labor and weather . . . Southeastern expects little labor or weather problems.

Of the 500 men in the "bachelor" field camp, about 425 will be Argentine nationals who will make up the drilling crews and provide casual labor. They will fill all positions on rig crews except for the drillers on the bigger rigs. The American contingent includes drillers, toolpushers, warehousemen, drilling engineers, drilling superintendents, office administrators, and other technicians.

The entire program will be controlled via a complete radio communications setup from operational headquarters in Comodoro Rivadavia 65 miles to the north, which also is headquarters for all other American companies working in the area.

All rigs and much of the automotive equipment is equipped with receiving and transmitting equipment.

Southeastern will be operating in much milder climate than it is accustomed to in its other large programs over the world. Argentina is going now into early summer, and at this time of the year temperatures in this area

drilling contract

The large bunkhouses are regular barracks-type buildings. The American supervisory force will live in skid-mounted, aluminum-skin buildings especially designed by Southeastern. Under their outer aluminum skin, these units have 2 in. of insulation and are lined on the inner wall with marine plywood. Beds and chests are built in. The complete units are moved in one piece and are ready for occupancy as soon as they are set down.

Small electric wall heaters furnish more than enough heat. And small air conditioners are at hand if artificial cooling is needed.

Along with the living quarters, the field camp will have one dispensary, three bathhouses, one full-size commercial laundry, one dining room, three electric kitchens, two freezer buildings, one recreation hall, one mess hall, and a field office.

All use the same basic design as the aluminum-skin dwelling units. All are completely equipped, skid-mounted, and can be set up in a matter of hours.

Similar units house the electric-generating facilities, four 125-kw. and two 115-kw. units. Electrical facilities all over the camp are quickly plugged into cables connected to generating units.

range from 75-85° F., with the thermometer climbing as high as 90° only rarely.

Winters also are relatively mild and dry with temperatures seldom dropping below the mid-20's at night and staying normally between 50-65° during the day. However, the temperature may drop to zero two or three times a year.

Prospects are that the company will be able to conduct year-round drilling with little difficulty.

An old oil area . . . Southeastern will be carrying out its huge drilling program in an area that has been producing oil since about 1907.

Production is found throughout the Comodoro basin in a Miocene sand ranging generally from 150 to 350 ft. thick. It is roughly 135 miles from Southeastern's area of operations on the south to the northwest flank of Pan American's area.

Actually, rather than one field, it is many. Comodoro wells generally produce about 250-400 bbl. daily from the tight, shaley sand stringers.

New Algerian Play

. . . slated as Mobil makes bow in the North African country. Firm buys into acreage north of Edjele.

MOBIL International is moving into the Algerian oil play by taking a 25% interest in an 8-million-acre concession held by a French company.

An affiliate of the international major has signed a preliminary agreement with Cie D'Exploration Petroliere (CEP) and associated companies for 25% interest in rights to about 8 million acres in the French Sahara.

The rights extend westward from the Libyan border in the Department of the Oases. The acreage lies between the Edjele and Hassi Messaoud producing areas. It is about 300 miles south of the Mediterranean and 100 miles north of Edjele. The area includes four permits with a total area roughly twice the size of Massachusetts.

Mobil and the CEP group plan an extensive exploration and development program. CEP, which for years has explored the area, will continue as operator in the new program. CEP is held 51% by the French Government agency, BRP, and 49% by various public and private French investment interests.

The contract will be submitted to the French Government for approval. Any crude produced by the companies from the Sahara will be considered French community crude.

The participation will be Mobil's first venture in French North Africa. The company has concessions in Libya, where it has made one discovery, and it is competing with others for acreage in the Spanish Sahara.

Two Mobil affiliates have made a discovery in Gabon, French Equatorial Africa, where they are carrying on a joint venture with a local French company. The find, at Rembo Kotto, tested 340 bbl. daily (OGJ, Oct. 5, p. 120).

Egyptian Fields Get Outlet

A PIPELINE linking two new Egyptian oil fields with an existing terminal on the Gulf of Suez has been completed. Commercial production from the fields is expected to start this month.

The pipeline will take crude from Ras Bakr and K'reim oil fields to Ras Gharib terminal. Output from the two fields is expected to average 10,000 bbl. daily in 1961, and 13,000 bbl. daily in later years.

The government-owned General Petroleum Co. is drilling Ras Bakr 19 and 20 and K'reim 6. The latest completion, Ras Bakr 18, tested 740 bbl. daily at 3,460 ft. There are at least 10 producing wells at Ras Bakr, the best of which tests 3,800 bbl. daily.

Belgium Due Test

. . . for oil if Shell receives acreage in southern area.

BELGIUM will be explored for the first time if the government approves a concession application by Royal Dutch-Shell.

A Shell Company has applied for rights over 650,000 acres in southern Belgium. The acreage lies in the southern part of Hainaut Province, in the center of Namur Province, and in the western part of Liege and Luxembourg provinces. If the rights are granted, exploration work will start as soon as possible.

Shell applied for a concession in northern Belgium 6 years ago, but the request was later withdrawn. Petrofina is seeking acreage in northern Belgium, but it is not known whether the negotiations have been concluded.

No drilling for oil as such has been done in Belgium. But three wells have been taken below 8,000 ft. in recent years for geological information, especially in connection with the local coal industry. None of the wells indicated oil possibilities. But oil traces have been found in a 180-ft. water well drilled 9 miles east of Tournai.

Austria to Pay Shell, Mobil

THE Austrian cabinet has agreed to pay Socony Mobil and Royal Dutch-Shell $13.7 million to compensate for holdings nationalized by the Nazis in 1938 and by the Russians in 1945.

The tax-free payments will be made in six equal installments. The agreement will become final when a contract is made for a joint marketing firm to be owned by the government and the companies.

Reports from Vienna are that the government will hold majority interest in the firm. The organization will buy crude from the parent companies, distribute it to refiners, then buy finished products for redistribution among the partners.

Austria agreed to compensate the companies in the "Vienna memorandum," signed in 1955 when it regained its freedom from occuping powers.

World Output Jumps

- **Venezuela's 212,000-bbl.-daily hike boosts world total. Canada declines, France gains.**

FREE-WORLD CRUDE production took a healthy 280,000-bbl.-daily step forward in October.

The start of the new cold weather season enabled Venezuelan operators to enjoy an increase of 212,900 bbl. daily. U. S. production rose about 54,000 bbl. daily. But these gains were offset north of the border where Canadian fields declined about 36,300 bbl. daily.

Middle East output reached an all time high of 4,688,200 bbl. daily. None of the individual producing countries set a new record, however, illustrating that the region is ready to produce a lot more oil whenever markets require.

France is moving into third place, behind West Germany and Austria, in Western Europe's roster of producing countries. Output of 6,000 bbl. daily, or more, from new fields in the Paris basin pushed total French production to a record 34,600 bbl. daily.

TREND OVER THE LAST YEAR

	Western Hemisphere less U. S.	Middle East	Total free-world outside U. S.
1958			
October	3,868.8	4,446.2	9,121.2
November	4,037.8	4,472.1	9,309.5
December	4,119.9	4,446.2	9,371.4
1959			
January	4,311.6	4,369.3	9,449.5
February	4,453.9	4,426.1	9,649.7
March	4,220.6	4,634.2	9,680.7
April	3,910.4	4,646.4	9,396.5
May	3,773.6	4,571.4	9,181.0
June	4,111.5	4,467.9	9,428.7
July	3,914.8	4,532.5	9,293.2
August	3,862.1	5,659.7	9,344.9
September	3,887.5	4,635.5	9,396.4
October	4,066.1	4,688.2	9,623.2

World-Wide Crude Production: Daily Average in Thousands of Barrels

Country—	Oct. 1959	Sept. 1959	Oct. 1958
Western Hemisphere			
Argentina	122.4	122.4	108.0
Bolivia	8.9	8.9	9.5
Brazil	75.0	75.0	57.4
Canada	509.0	545.3	434.1
Chile	18.6	18.5	15.2
Colombia	151.3	148.9	128.5
Cuba	.4	.5	.9
Ecuador	7.6	7.6	8.2
Mexico	265.0	265.0	261.2
Peru	47.2	47.2	51.5
Trinidad	114.2	114.6	104.6
Venezuela	2,746.5	2,533.6	2,689.7
Total	4,066.1	3,887.5	3,868.8
Europe			
Austria	45.0	45.0	51.9
France	34.6	33.9	27.5
West Germany	101.5	100.4	89.1
Italy	30.6	30.6	33.9
Netherlands	33.7	33.7	33.3
United Kingdom	1.7	1.7	1.7
Yugoslavia	12.0	11.9	8.9
Total	259.1	257.2	246.3
Middle East			
Bahrain	45.0	45.2	45.2
Iran*	948.0	1,011.0	827.0
Iraq†	915.8	915.8	798.0
Israel	2.0	2.0	2.0
Kuwait	1,411.8	1,298.3	1,442.7
Neutral Zone	118.6	118.6	106.2
Qatar	173.1	181.1	185.0
Saudi Arabia	1,066.2	1,055.8	1,034.6
Turkey	7.7	7.7	6.5
Total	4,688.2	4,635.5	4,446.2

Country—	Oct. 1959	Sept. 1959	Oct. 1958
Other Asia			
British Borneo	110.0	110.0	106.9
Burma	10.5	10.5	10.5
India	8.5	8.5	8.5
Indonesia	340.0	355.0	325.0
Japan	7.8	7.8	7.6
New Guinea	4.5	4.5	5.1
Pakistan	5.9	5.9	5.9
Total	487.2	502.2	569.5
Africa			
Algeria	29.4	21.3	11.3
Angola	0.9	0.9	0.8
Egypt	62.2	62.2	58.9
Gabon	15.3	15.8	11.3
Morocco	1.8	1.8	1.5
Nigeria	13.0	12.0	6.6
Total	122.6	114.0	90.4
Free World			
Foreign	9,623.2	9,396.4	9,121.2
United States	6,911.0	6,857.0	7,136.0
Total	16,534.2	16,253.4	16,257.2
Communist Countries in Soviet Orbit			
Romania	235.0	235.0	227.0
Russia	2,688.0	2,688.0	2,260.0
Others	100.0	100.0	60.0
Total	3,023.0	3,023.0	2,547.0
WORLD TOTAL	**19,557.2**	**19,276.4**	**18,804.2**

Figures are from reliable industry reports or government sources. Estimates are made where complete reports are lacking. *Includes estimated 5,000 bbl. daily from Naft-i-Shah field not operated by Consortium companies. †Includes estimated 3,300 bbl. from Naft Khaneh field, operated by Iraq Government.

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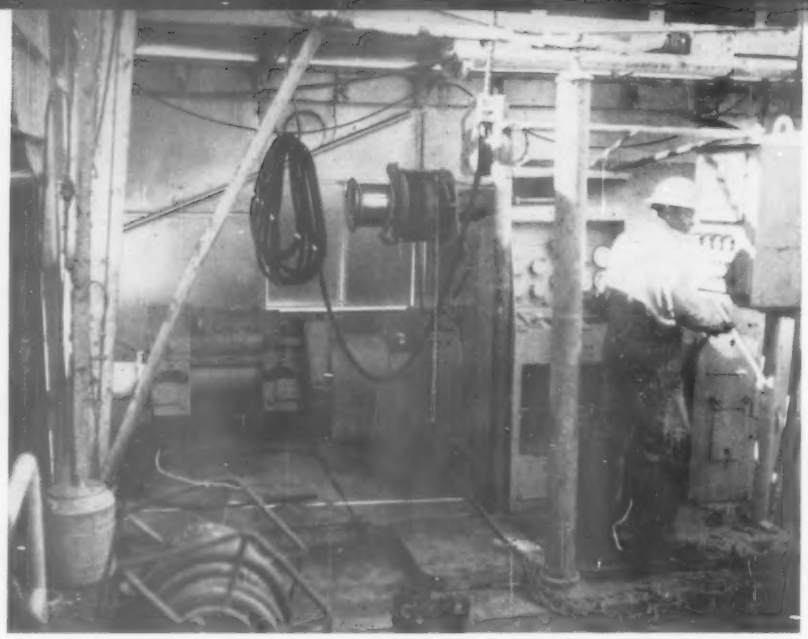


ONE OF THE TWO d.c. motors which power Rig 32's unique draw works is shown at left in this photo. Second motor is inside the draw-works case where the shifting transmission would normally be.

BY ED McGHEE
Drilling Editor

Some drilling-equipment men see the precedent-shattering rig described here as the prototype for many new rigs of the next few years.

Helmerich & Payne's formula for an

RIG 32 of Helmerich & Payne is probably the only deep-drilling draw works of modern times with only two "speed ratios."

It is also quite likely the only electric rig now operating which can split the output of its d.c. generators.

Rig 32, moreover, is one of the few in existence which has a single ebullient cooling system for all rig engines.

It is one of only a small number using a lightweight V-type mud pump.

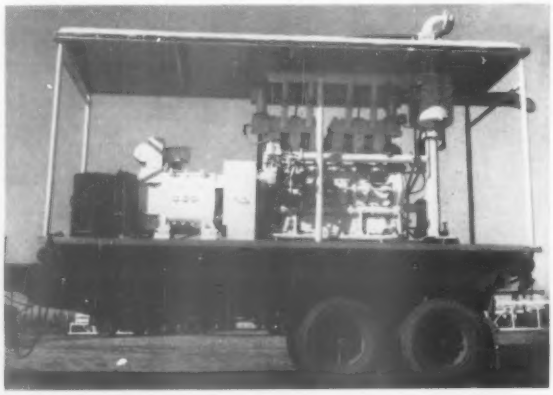
Because of these things, Helmerich & Payne has been able to assemble a big electric rig at relatively low cost. In fact, the firm estimates its investment in Rig 32 is roughly the same as it might expect for a mechanical drive of the same capacity.

Heretofore, the purchase-price advantage has always been on the side of mechanical drive. Now, some see the Helmerich & Payne rig as the forerunner of a new generation of competitively priced units which could make electric drive prevalent in drilling.

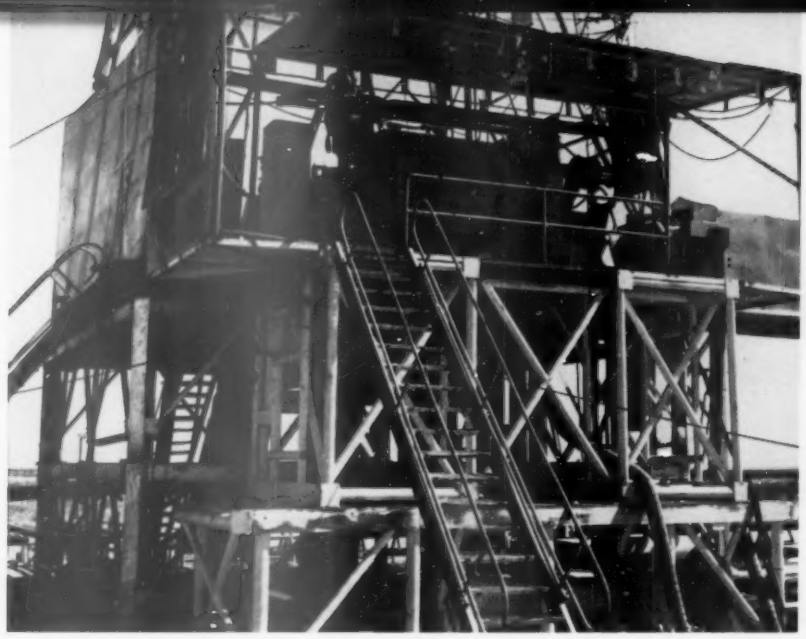
Helmerich & Payne expects Rig 32 to be cheaper to move and cheaper to operate than are mechanical-drive and customary electric rigs. In the long run, these economies may be even more important than the reduced purchase price of the unit.

High, low clutches. Most mechanical-drive rigs of today have six forward and two reverse speeds. Such a wide range of speeds is necessary to enable the driller to best use available engine power in each of a multitude of different jobs. Rig engines run at constant speed, so the speed ranges in the draw works must compensate.

NEW CONTROL SYSTEM, housed on this auxiliary skid, makes it possible to split the output of the generators. Thus, for the first time on a drilling rig, current from a single generator can be used to drive two separate motors.



ENGINE-GENERATOR set, one of three, is shown here in the process of moving. Notice the ebullient-cooling piping on the engine. This system eliminates the need for conventional radiator, fan, and water pump. Engine exhaust is fitted for water injection.



REAR of the modified Oilwell 96 draw works. Three-speed transmission has been removed and replaced by motor shown inside draw-works case. Second motor is shown on driller's side with output shaft coupled to drum drive shaft.

economical electric rig

Of course, speed changes are obtained by use of a "selective" or "shifting" transmission.

In place of such mechanical shifting, Helmerich & Payne has substituted d.c. electric motors. The motors, unlike internal-combustion engines, can run at variable speeds under load. Moreover, the d.c. motors have a high starting torque. They are not harmed by being stalled out. Thus, Rig 32 is well equipped to handle a wide range of drilling loads although there are only two drive ratios to the draw-works drum.

The two drum ratios are obtained by keeping the conventional high-drum and low-drum clutches in the drive. No reverse shift is necessary because the motors themselves are directly reversible.

Helmerich & Payne believes that the elimination of so many chains and clutches from the rig will certainly cut maintenance costs. There is only one other known application where a drilling rig is taking advantage of the speed-torque characteristics of d.c. motors to such an extent. This application is on a shallow-drilling rig digging sulfur-production wells. On this rig, since loads are lighter, there is no means at all of changing the speed ratio between driving motor and the drum.

Conventional draw works. Rig 32's draw works is a reconditioned Oilwell 96 from which the selective transmission has been removed. In the rear of the draw-works case where the transmission had been, there is now a General Electric 752 d.c. motor. A second, and identical, motor sits outside the draw-works case on the driller's side. These two motors are on the same shaft, with a compounding clutch between.

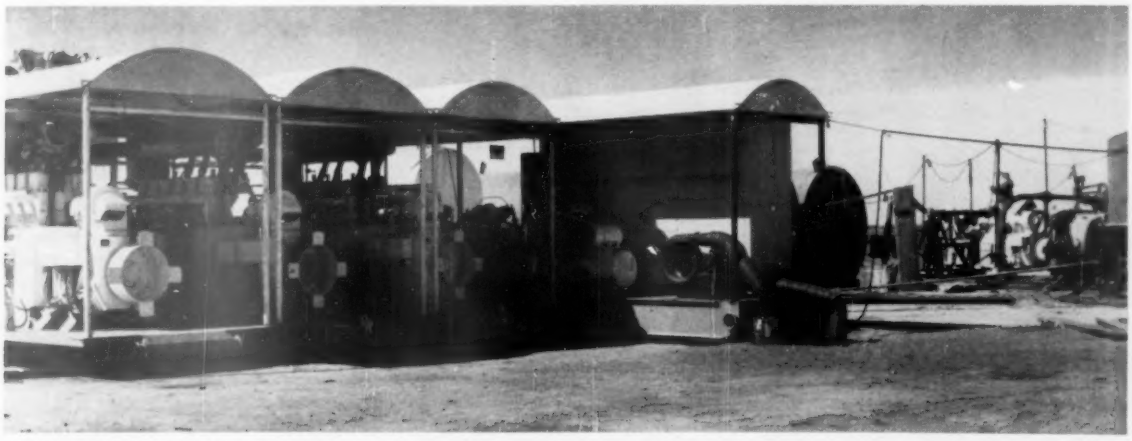
The motor inside the case is called the rotary motor; its shaft carries sprockets for chain drives to both the rotary countershaft and the high-drum clutch.

The motor outside the case is called the draw-works motor. It is coupled to sprockets for chain drives to the catshaft and the low-drum clutch.

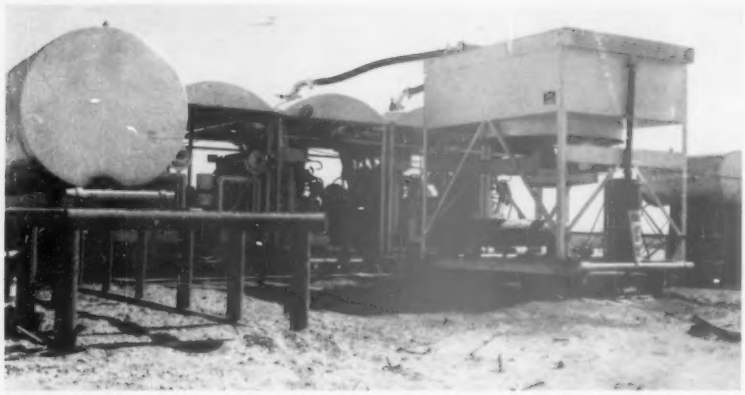
If desired, the rotary can be turned independently by the rotary motor while the draw-works motor operates the drum and the catshaft. Or, both motors can be put to driving the draw-works drum. Speed of both rotary and drum are infinitely variable because of the variable speed of the d.c. motors.

Making trips. Each of the draw-works motors is rated at 1,050 hp. for hoisting. Any two of the power plant's three generators can be put on the draw-works motor; or any two may be put on the rotary motor.

When both motors are needed for

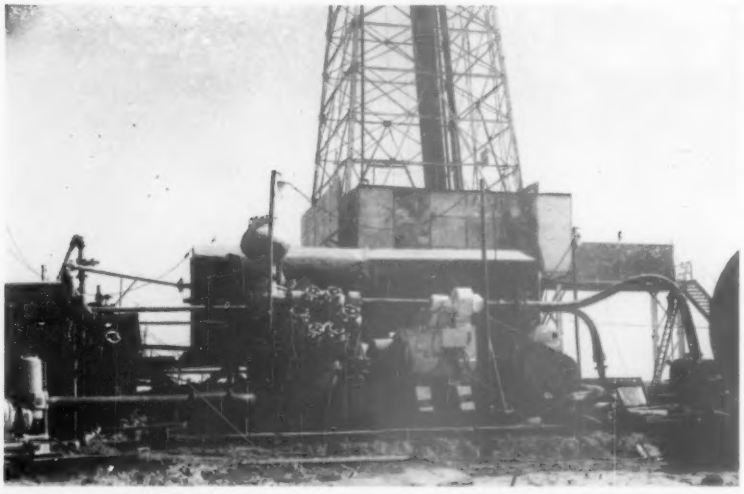


RIG 32'S COMPLETE POWER PLANT in place for drilling. Blowers on the end of the auxiliary skid at right provide cooling air for the two motors powering the draw works and rotary table.



HORIZONTAL atmospheric-type cooler condenses steam generated in the jackets of the three main engines. Vapor from the engines enters a common header and condensed water leaves through a common line.

SECOND PUMP in Rig 32's mud system is a conventional Oilwell 220P, shown here during a move. Neither pump needs precise alignment since they connect only to the suction piping, not to a V-belt drive off a rig compound.



V-TYPE PLUNGER PUMP with its driving motor makes compact, easily transported unit. Charging pump is on the extreme left; it provides positive suction head, thus preventing knocking at all speeds of the big V-pump.

hoisting, total power available is, of course, dependent on the power output of the generating plant. Each of the three Waukesha LRO gas engines is rated at 470 hp. intermittent at top operating speed of 1,050 r.p.m. Counting efficiency losses in electric generation and transmission, this means a maximum of about 1,300 hp. is available at the drum.

On trips from shallow depths, the company expects the two-step electric drive will pull the pipe as fast, or faster, than a mechanically driven Oilwell 96 rig. On trips from the total rig depth, Helmerich & Payne believes the stepless speed increase of the electric motors will make up for any time that might be lost because of the lack of a "low-low" gear or absence of greater total available power.

Power plant. On other diesel-electric and gas-electric rigs now in the field, it is impossible to split the output of a direct-current generator. That is, when a particular motor is running, it must take the entire output of one particular generator. It isn't possible to run two motors simultaneously off the same generator.

Rig 32 has a new control system which, for the first time in rig drives, makes it possible to split generator output. That is, the same generator which is powering the rotary may also supply current for another motor to turn the catshaft. Or, when two generators are put on the rig-pump motors, it still may be possible to draw off a portion of the power for other uses.

There are four large d.c. motors on the rig: the two at the draw works and one on each of the mud pumps. It should never be essential to operate more than three of these at any given moment. For that reason, as Rig 32 is presently equipped, there will ordinarily be one generator available for each operating motor. This wouldn't be the case if one of the engines should be out of service.

Thus, the split-output control system is a safeguard against loss of an engine. It is also a means of cutting down the number of engines. Later on, Helmerich & Payne plans to substitute a large single prime mover for two or more of the engines. With fewer prime movers, the split-output control will be even more important.

Cooling by ebullition. Helmerich & Payne has been able to boost the effective power output of its three Waukesha LRO engines by using ebullient cooling. Conventional radiator-cooled engines may waste as much as 25 to 30 hp. in their water pumps and cooling fans. An ebullient-cooled engine needs neither. Moreover, the company believes its ebullient engines will

be cheaper to operate and maintain than if radiator-cooling were used.

Water jackets of all three engines are tied to a common condenser. This condenser is a single horizontal-fan atmospheric cooler. The fan is driven by an a.c. motor. Power for this motor and all other auxiliary equipment is from engine-driven a.c. generator units.

No water pump is needed in the circuit because there is thermal circulation from engine jackets to cooler back to engines. Jacket water in the engines actually boils, with steam leaving the engines at about 205° to 207° F. The condensed vapors return to the engines at about 203° to 205° F.

Helmerich & Payne selected the single-condenser system rather than an individual-engine condenser system like that used on some drilling rigs. While the single large condenser means an extra package to transport during rig moves, it is much cheaper to buy and simplifies engine-skid layout.

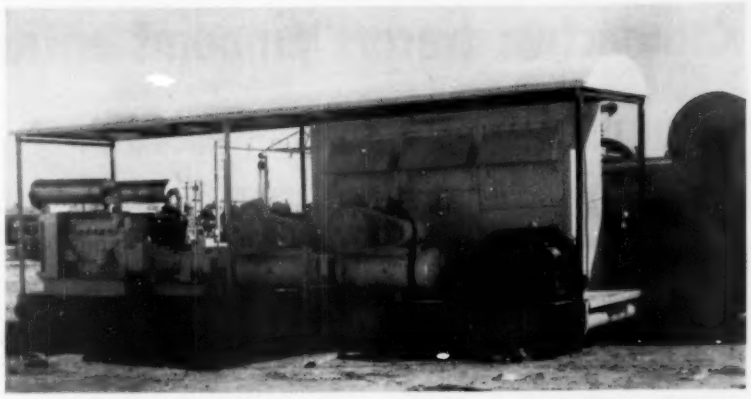
Each of the engines is part of a skid-mounted package. Other major equipment on the skid is the direct-coupled d.c. generator. On location, the three-engine-generator skids are mounted side by side, with the roofs over the skids forming an unbroken shelter. Fuel lines are an integral part of the base skid.

Auxiliaries. Auxiliary a.c. generators are mounted on a separate skid unit. There are two gas engines driving a.c. generators. In addition, this skid also carries the switchgear for the d.c. generators and motors and two air-compressor sets.

Besides this equipment, the auxiliary skid carries two a.c.-motor-driven air blowers. These blowers supply cooling air to the draw-works and rotary motors which are more than 100 ft. away. Purpose of this arrangement is, of course, to prevent air from the vicinity of the wellhead from entering the motors. Thus, even if gas is escaping at the wellhead, the rotary and draw-works motors may be run with no danger of causing an explosion.

The air lines for this service are 8 in. in diameter and are buried between the auxiliary skid and the derrick substructure.

Other electric rigs have naturally been faced with this same problem of providing safe cooling air for rig-floor motors. Most have solved it by placing the air blower atop the big d.c. motor. Then, a suction pipe is run to a safe distance away from the wellhead. Helmerich & Payne's positive air pressure, as maintained by the blower, should mean a greater volume of air circulated through the motor for the same power consumption. In addition, Rig 32's system has no worry of air leaking into the line as does a rig using long suction lines.



COMPLETE AUXILIARY SKID contains twin light plants and twin motor-driven air compressors, in addition to blowers which provide cooling air for draw-works motors. All motor and generator controls are housed in the cabinet on this skid.

Rig 32's main drilling engines and its auxiliary-power engines are fitted for water injection into the exhausts. All these engines are more than 100 ft. from the wellhead and all exhausts point away from the well, but water in the exhausts supplies an added measure of insurance.

Pumping power. Rig 32's main pump is a Cardwell V-700, a new V-type plunger pump. Larger models of this pump have been in the field for more than 2 years, but Rig 32's unit is the first of a new, lower-horsepower series.

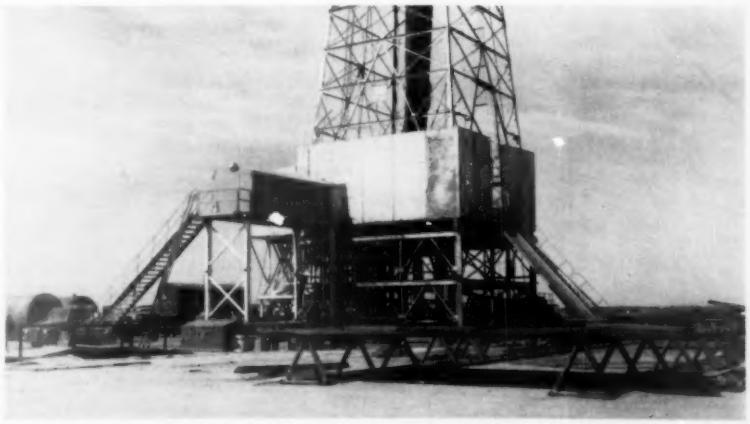
Crankshaft on this pump is directly coupled to the output shaft of the driving GE 752 motor; result is a lightweight and compact unit.

Since plunger pumps are single acting, they must ordinarily run faster than double-acting pumps. For this reason, Rig 32's has a 6 by 8 centrifugal pump for charging the suction of the big V-pump. Such a charged suction prevents fluid knock in the pump even at its highest operating speeds.

Second pump is a conventional Oilwell 220P. Driving motor is mounted crosswise behind the power end of the pump; drive is through a chain to a sprocket on the pump's input shaft.

Of course, neither of the pumps requires such careful alignment as it would if driven off a rig compound. The fluid ends need only be connected to the suction flanges on the mud tank.

On its first location, Rig 32 is working under a conventional derrick. Later on, as the rig's operating characteristics become better known, Helmerich & Payne plans to change to a portable mast if this appears economically attractive.



DOG HOUSE is mounted on folding legs so that it is lowered directly atop its base for moving. Base contains storage for tools. Rig 32 is presently working under this conventional derrick; later on, if it proves economic, the company plans to change it to a jackknife mast.

Radioactive tracers pinpoint entrainment of vacuum-still bottoms in Sinclair's tower overhead streams

PART 1 OF TWO PARTS

BY G. B. HOEKSTRA, A. I. SNOW
L. A. BAILLIE, AND J. S. CURTICE
Sinclair Research Laboratories, Inc., Harvey, Ill.

ENTRAINMENT of vacuum-still bottoms in tower overhead streams can be effectively pinpointed through use of radioactive tracers. In studies made at Sinclair Research Laboratories, Inc., Harvey, Ill., entrainment studies were made over a wide range of still loadings. The significant data developed in the tests will be presented in detail in Part 2 of this discussion.

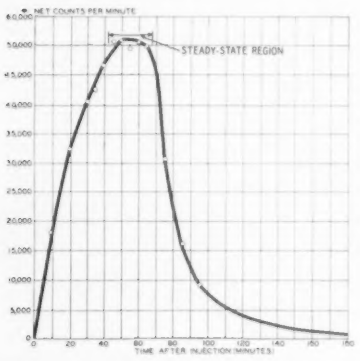
The technique followed in application of tracers in the study are covered here.

The tracer was radioactive cobalt-60 naphthenate. Laboratory flash still tests indicated that it had negligible volatility at refinery vacuum-still conditions. This is a highly desirable property since its presence in a distilled product can then be directly attributed to entrainment.

As a check on the effectiveness of the tracer study entrainment quantities were also determined by color comparison (light transmission) of refinery gas oil with the color of blends of asphalt and clean gas oil of known composition. The color method and radioactive - tracer method showed good agreement. Since these two methods are independent of each other their agreement attests to the reliability of both methods.

The color method is useful when a light-colored material is contaminated by a dark material. It is used to determine asphalt entrainment in gas oil, but cannot be used to determine asphalt entrainment in the normally dark runback.

Author Hoekstra is in the process-design division, and Authors Snow, Baillie, and Curtice the radiation division of Sinclair Research Laboratories.



ASPHALT ACTIVITY as function of time for 1-hour injection on Still 3. Fig. 1.

The experimental program consisted first of the determination of cobalt naphthenate volatility by means of a laboratory flash still followed by 14 entrainment tests on three refinery vacuum stills. Two of these stills (Stills 1 and 2) were similar in size and design. They differed principally in that one still contained three bubble trays above the flash zone while the other contained two trays and a demister pad. Still 3 contained two trays and a demister pad. One of the trays contained no bubble caps and probably was ineffective for entrainment removal.

Determination of entrainment . . . The amount of bottoms entrained in the overhead is related to the concentration of tracer in the overhead and the concentration of tracer in the bottoms. The concentration of bottoms in the overhead is given by:

$$W = (R/C) \times 100$$

Where:

W = volume per cent bottoms in the overhead.
R = tracer count in the overhead, counts per minute per milliliter.
C = tracer count in the bottoms, counts per minute per milliliter.
Tracer count = sample count minus background count.

The limits of error in counting due to counting statistics are given by the following equation:

$$Y = (N_s/t_s + N_b/t_b)^{1/2}$$

Where:

Y = error in counting determination when background count is subtracted from sample count. Y is the standard error.
N_s = sample count in counts per minute.
N_b = background count in counts per minute.
t_s = time in minutes over which sample count is taken.
t_b = time in minutes over which background count is taken.

The limits of error on data presented in Tables 1 and 2 were obtained by means of this equation plus a conservative estimate of other errors in handling samples.

Counting was performed by the scintillation technique using a sodium iodide (thallium activated) crystal as the detector. Eight-hundred-milliliter samples of gas oil were counted. Bottoms samples were readily counted in the well of the sodium iodide crystal since their higher activity level per-

Table 1– Test Results

Test No.	1	2	3	4
Still No.	2	2	2	2
Flash-zone temperature, °F.	748	753	752	742
Flash-zone pressure, mm. Hg	44	42	42	42
Gas oil, bbl. per hour	314	354	350	241
Asphalt, bbl. per hour	182	156	160	127
Runback, bbl. per hour	85	55	54	85
Reflux, bbl. per hour	55	50	50	44
Flash-zone "C" factor	0.078	0.085	0.085	0.063
Vol. % asphalt in gas oil*	0.19±0.02	1.76±0.10		0.026 ±0.006
Vol. % asphalt in runback*	48.3±4.8	54.0±5.4		47.4±4.7
Vol. % runback in gas oil*	0.39±0.03	3.26±0.15	3.77±0.21	0.054±0.006
Location of tracer injection	feed	feed	liquid to tray above flash zone	feed

*From radioactive tracer data.

mitted the use of a smaller sample volume.

Streams from two of the stills tested consist of gas-oil product, asphalt product, and a runback stream which is recycled. Third still did not have a runback stream. Radioactivity determinations permit three entrainment measurements for two of the stills and one measurement for the other still:

$$\frac{\text{(counts/min./ml.) overhead}}{\text{(counts/min./ml.) asphalt}} = \text{asphalt entrainment in overhead.}$$

$$\frac{\text{(counts/min./ml.) runback}}{\text{(counts/min./ml.) asphalt}} = \text{asphalt entrainment in runback.}$$

$$\frac{\text{(counts/min./ml.) overhead}}{\text{(counts/min./ml.) runback}} = \text{runback entrainment in overhead.}$$

Correlation of entrainment . . . Entrainment was correlated in terms of "C" factors. The still loading is spoken of in terms of the "C" factor. The "C" is defined as:

$$\text{"C"} = \frac{V}{[(\rho_l - \rho_v)/\rho_v]^{1/2}}$$

Where:

V = tower vapor velocity, ft./sec.
ρ_l = liquid density.
ρ_v = vapor density.
"C" = a constant expressing the tendency of the system to entrain liquid droplets.

The above equation is derived by Souders and Brown[1] on the basis of a theoretical suspending velocity. Factor "C" depends upon surface tension, the geometry of the system, and the service conditions. It is best determined empirically.

Selection of the Radioactive Tracer

The tracer chosen must have the following properties:

1. Chemically stable at vacuum-still conditions.
2. Not surface active since adsorption on walls of the vacuum still would lead to erroneous results.
3. Low volatility at vacuum-still conditions so that entrainment alone can be measured.
4. Since the refinery products are in public use the radioisotope used should be detectable at concentrations well below the Atomic Energy Commission's "unrestricted area" limit for effluent materials. For cobalt-60 the "unrestricted area" concentration limit is 10,000 times as great as the concentration which can be detected.

Cobalt-60 naphthenate fulfills the requirements given above quite well and has successfully been used in individual entrainment experiments by previous workers.[2]

In our experiments the greatest concentration of cobalt-60 in any product obtained during our experiments was about 5% of the AEC unrestricted area limit.

Preparation of Radioactive Tracer

The cobalt-60 naphthenate was prepared in our laboratories by exchange of inactive cobalt naphthenate dissolved in naphtha with an aqueous solution of cobalt-60 nitrate at a pH of around 7. Contact between the two phases was established by shaking in a separatory funnel.

The naphthenic acid used in preparing the inactive cobalt naphthenate was obtained by selecting the two highest-boiling cuts from a fractionation of commercial naphthenic acid. The exchange reactions were carried out in a shielded cave in our radiation laboratory.

Tracer volatility . . . A laboratory flash still[3] was used to determine the vapor pressure of cobalt naphthenate tracer. The still permits the flashing of reduced crudes at carefully controlled conditions of temperature and pressure and at very low vapor velocities.

TABLE 2—TEST RESULTS FROM STILL 3 TRACER INJECTION INTO FEED

Test No.	12	13	14
Flash-zone temperature, °F.	750	750	745
Flash-zone pressure, mm. Hg	33	27	22
Gas oil, bbl. per hour	135	171	182
Asphalt, bbl. per hour	178	209	216
Reflux, bbl. per hour	10	10	6
Flash-zone "C" factor	0.115	0.146	0.156
Vol. % asphalt entrainment in gas oil (by tracer)	<0.01	<0.01	0.97±0.06
Gas-oil color (optical density)	366	433	3,050
Gas-oil metals:			
NiO, p.p.m.	0.77	1.98	4.0
V_2O_5, p.p.m.	1.02	2.85	16.8

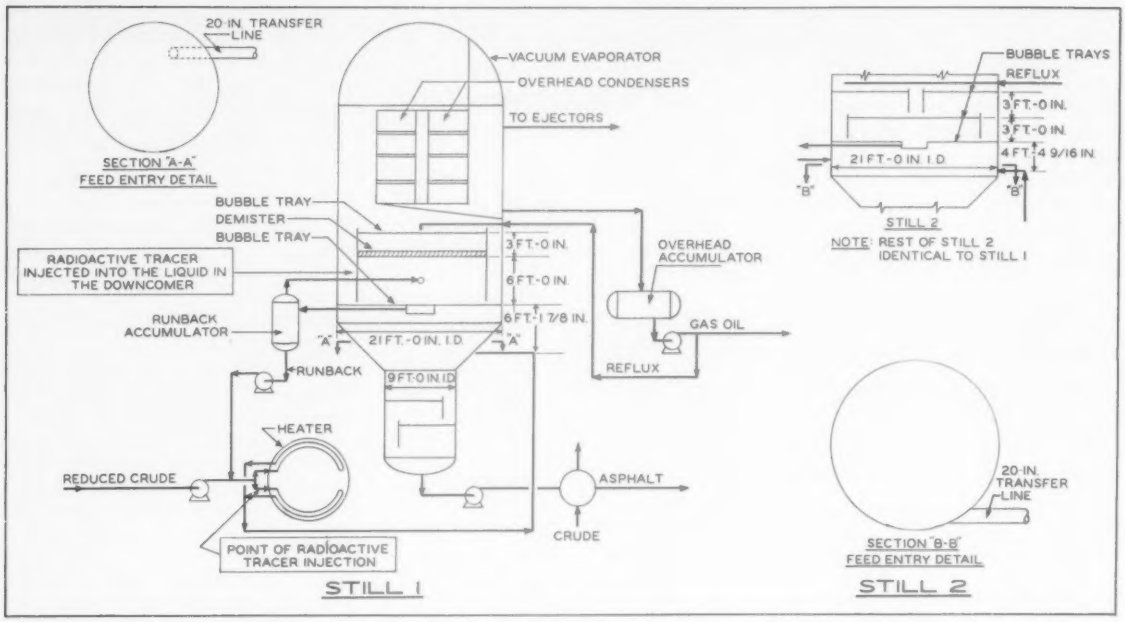
from Stills 1 and 2

5	6	7	8	9	10	11
1	1	1	1	1	1	2
759	722	707	707	762	759	751
40	30	26	26	36	36	47
284	323	401	401	298	233	314
138	181	197	197	102	86	112
80	80	80	80	35	38	64
30	30	10	9	30	30	40
0.074	0.087	0.114	0.114	0.075	0.061	0.075
<0.007 ±0.004	0.018	<0.015 ±0.008		0.010 ±0.004	<0.009 ±0.003	
57.4±5.7	90.9±9.1	94.5±9.5		72.8±7.3	67.9±6.8	
			0.012±0.05			0.35±0.02
feed	feed	feed	liquid to tray above flash zone	feed	feed	liquid to tray above flash zone

Fortunately, the count at the lowest loading even if attributed entirely to vapor pressure represents a negligible

Feed consisted of Kuwait reduced crude containing the tracer. Tests were run at temperatures of 600°, 650°, and 700° F. Still loadings were varied for tests at a constant temperature to determine if entrainment was responsible for tracer in the overhead.

Tracer was detected in the overhead for all tests. Counts per minute per 800 ml. in a series of tests at 650° F. and 4 mm. Hg pressure were 199, 164, and 64, at "C" factors of 0.050, 0.0179, 0.0061, respectively. These results show that entrainment was responsible for some activity in the overhead, possibly at even the lowest loading.



INJECTED TRACER enters Stills 1 and 2 either in the feed or in the liquid to the tray above the flash zone. Fig. 2.

vapor pressure. Vapor pressures have been calculated at 600°, 650°, and 700° F. attributing all overhead activity to vapor pressure. The loading for these tests was a "C" factor of 0.0061 which was the lowest test loading.

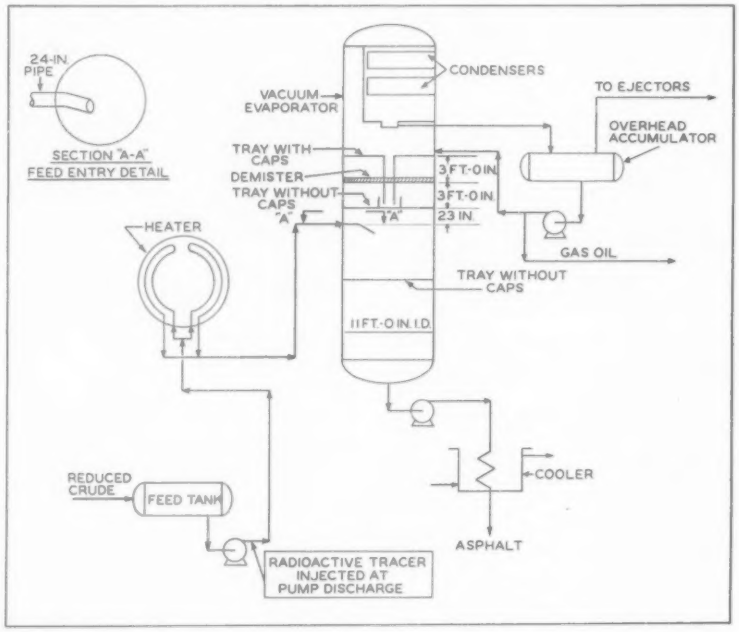
Extrapolation of the calculated vapor pressure gives a value of about 0.004 mm. Hg at 750° F. Using this value at typical vacuum-still flash-zone conditions of 750° F., 42 mm. Hg, and 67 vol. % overhead, the apparent entrainment in the overhead due to vaporization is only 0.0019 vol. %. Therefore, the data show the tracer is essentially nonvolatile.

A test was made on the laboratory flash still to determine if the tracer undergoes reversible adsorption on metal surfaces. At the end of a flash-still test where radioactive tracer had been used, a fresh charge containing nonradioactive reduced crude was introduced as feed, and several overhead and bottoms samples were examined for radioactivity. No trace of radioactive material was found in either bottoms or overhead samples indicating that reversible adsorption had not occurred.

Injection procedure . . . In the refinery tests the tracer was continuously injected for a long enough time to insure that a steady-state concentration was reached with respect to both bottoms and overhead. Samples were taken simultaneously from the product accumulators.

Several samples were taken near the end of the test period so that the change in radioactivity as a function of time could be followed and one could be assured that a steady state had really been attained. Fig. 1 shows the attainment of such a steady state in a refinery test.

The tracer was injected into the feed or into the liquid to the tray above the flash zone. Runback is drawn from this tray. The tray liquid injection increased the concentration of tracer on the tray and so provided increased sensitivity for the measurement of the amount of tray liquid entrained into the gas oil. Diagrams of the three stills are given in Figs. 2 and 3.



INJECTED TRACER enters Still 3 with the feed just below tray without caps and demister. Fig. 3.

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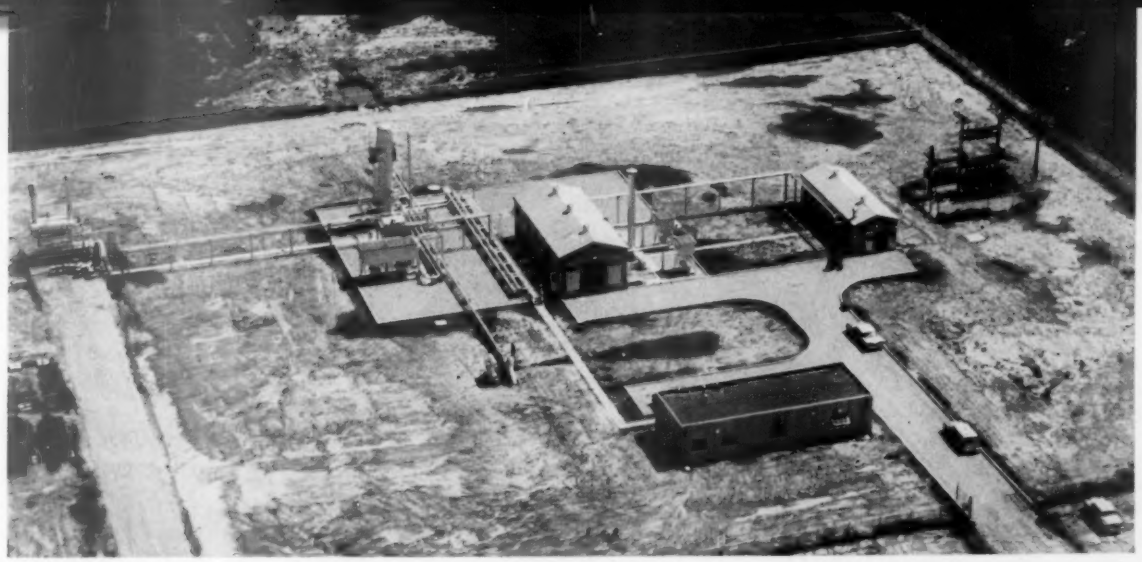
2. Hull, D. E., Nucleonics, 13, 18-21, 1955.
3. Smith, R. B., et al., Ind. Eng. Chem., 43, 766-70 (1951).



AERIAL VIEW shows compressor building in center, auxiliary building housing electrical control panels at right adjacent to electrical substation, and dehydration plant at left.

Electric reciprocating compressor powers station at IPC's gas-storage field

BY KENNETH W. ROBERTSON

. . . gas-storage engineer, Illinois Power Co., Decatur, Ill. Robertson was graduated from Purdue University with a B.S. in electrical engineering in 1949. He was with the mechanical engineering section, production department, Shell Oil Co., in Odessa, Tex., for 6½ years. Since 1956 he has been in charge of the development of underground gas-storage facilities for Illinois Power.

THE FREEBURG compressor station of Illinois Power Co. has been completed to serve the company's Freeburg gas-storage field. The station and field will supplement the gas supply to Belleville and East St. Louis, Ill., during days of high gas demand. When the gas demand is low, the plant will be used to pump gas into 31 gas-storage wells in Freeburg storage field.

Designed and constructed by Stearns-Roger Manufacturing Co., of Denver, the initial installation includes two 700-hp. electric - motor - driven compressors, compressor auxiliaries, and a complete triethylene glycol natural-gas-dehydration unit. A control system is installed to permit automatic operation of the compressor. A compressor building, auxiliary building, and a combination office-warehouse building provide housing for the plant.

Expansion plans call for a total station horsepower of 2,800. Two additional compressors, extension of the compressor building, and additional main gas cooling will be required in future years. The dehydration plant has been designed to accommodate the ultimate operating conditions.

Motor-driven compressors . . . The main gas stream is compressed by two electric - motor - driven compressors. These compressors are the balanced-opposed type with three double-acting cylinders and are furnished with air-operated suction-valve unloaders for controlling load and gas throughput. The power units are 4,160-volt, 3-phase, 60-cycle, a.c. 700-hp. totally enclosed, force-ventilated electric motors.

Electric-motor drive was chosen over internal-combustion-engine drive for this installation for three reasons:

1. Ample electrical capacity was available from company-owned power-generating and transmission facilities, whereas the demand for gas has exceeded our supply in this area for several years.
2. Lower anticipated maintenance costs with the synchronous-motor drive.
3. Simplicity in achieving automatic starting, stopping, and load control of the compressors.

Totally enclosed, force - ventilated synchronous motors were selected because of their lower cost and higher power factor as compared to induction motors in the 700-hp. size.

Each compressor has its own individual closed jacket system which consists of a jacket-water pump, air-cooled jacket-water cooler, and a surge tank. Temperature is controlled by thermostatically operated three-way bypass valves installed at the cooler. The compressors' lubricating oil is cooled by the jacket-water system in a shell-and-tube heat exchanger.

The dehydration plant consists of a glycol contactor, glycol pumps, glycol aerial cooler, glycol heat exchanger, glycol filter, surge tank, and regeneration unit. The unit is designed to produce a 75° F. dewpoint depression with a maximum gas contact temperature of 90° F. and a maximum ambient temperature of 70° F.

Design basis . . . The compressor and dehydration plant have been designed

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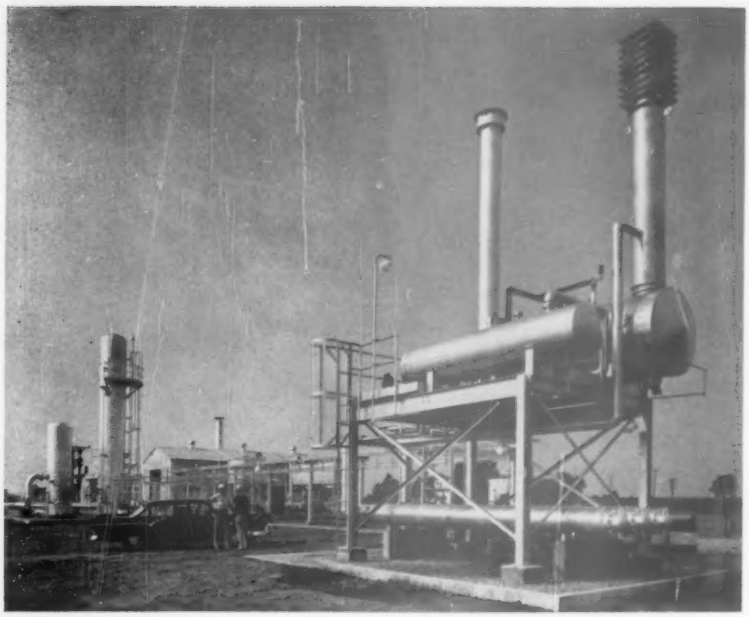
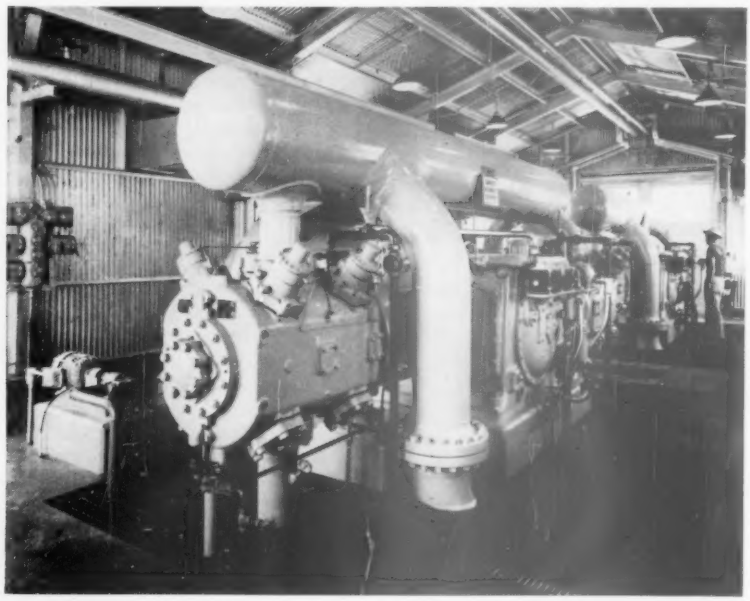


GLYCOL-REGENERATION unit, surge tank, and heat exchangers are in right foreground. Inlet scrubber, glycol contactor, and compressor building are in background.

for an initial rated gas capacity of 24,000 M.c.f. per day with a suction pressure of 144 to 65 psig. and a discharge pressure of 165 psig. The ultimate design condition is for a gas throughput of 36,000 M.c.f. per day with the same range of suction pressures and a discharge pressure of 260 psig.

The control system has been designed so that all control functions can be initiated at the plant for initial plant operation. However, provisions have been made for the major controls to be initiated from Illinois Power Co.'s central gas-dispatching point in Decatur, Ill., should this be desired at a later date to achieve essentially unattended operation.

Totalized flow which has been mechanically compensated for pressure and temperature is telemetered to the gas-dispatching office in Decatur at present. This is accomplished with a triple integrating orifice meter with a remote counter.



THE 700-HP. COMPRESSOR units in this view largely conceal the drive motors.

Control System

The compressor control has been designed to maintain a constant discharge pressure when using the two initial compressors or the four ultimate units. It will automatically load single or multiple units, as required, and will add or stop additional compressors.

The plant pressure controller provides the initial signal for the control. Output air from this instrument is connected to two pressure switches. One is set to actuate the controls for normal loading response and the other for rapid loading response.

Each switch has two sets of contacts—one for starting and loading the compressor and one for unloading and stopping the compressor. Actuation of one of the switches by the output air from the plant pressure controller energizes a circuit which drives a stepping switch to accomplish the sequence of loading.

Compressors are started and stopped in an established sequence. To start a compressor, the control will first start the ventilating blower for the synchronous motor, lube-oil pump, lubricator, jacket-water pump, and jacket-water cooler fan. These utilities will be in operation for about 2 minutes before the compressor drive motor is started. The sequence is reversed when a compressor is stopped. All cylinders are automatically unloaded so there is no load on the drive motor when the motors are being started or stopped.

Compressor loading . . . Control is based on a "dead zone" which is adjusted by setting the proportional band on the plant pressure controller. The compressor loading occurs in steps of an established sequence. For the two initial compressors, there are a total of eight steps—four for each machine. In taking one compressor from a completely unloaded or stopped condition to a fully loaded condition, the following sequence occurs:

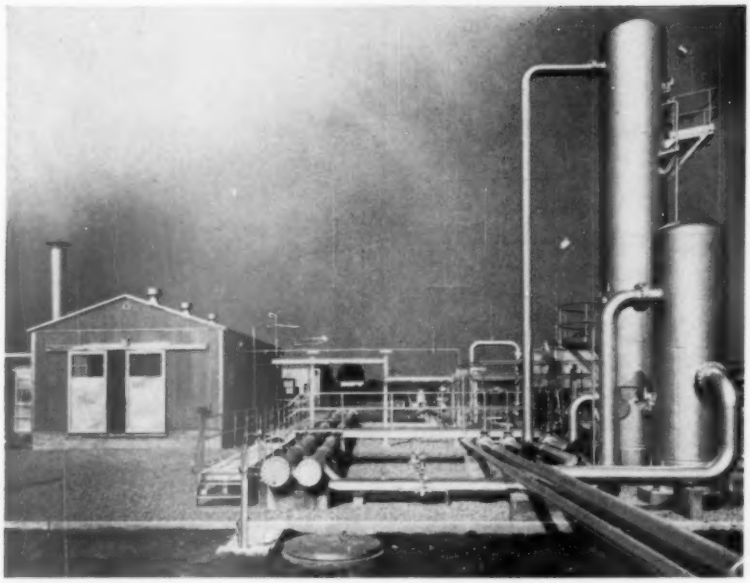
Step No. 1—Load No. 1 cylinder as double acting.

Step No. 2—Load No. 2 cylinder as double acting.

Step No. 3—Load crank end only of No. 3 cylinder.

Step No. 4—Load head end of No. 3 cylinder.

Unloading occurs in the reverse of this sequence. Selector switches have been provided so that any compressor may be set to start first and stop last in the loading sequence. The compressors' sequence can be changed to insure even wear and use. An engine-hour counter is provided on each compressor control panel.



PROCESS AREA, piping, and compressor building are shown. Stack at left is air inlet to forced-ventilation system for compressor-drive motors.

The loading or unloading steps occur only when the gas pressure is lower or higher than the limits of the "dead zone" of the controller. When line pressure drops below the dead zone, the control system will automatically load the next step in the loading sequence. If the pressure rises above the dead zone after this loading, the control will unload the same cylinder or step that was previously loaded. The control attempts to maintain the plant discharge pressure within the dead zone setting.

To avoid rapid fluctuations between the limits of the dead zone, the time of response between steps has been set at 15 minutes. If an increase in the gas load on the line fed by the plant causes the pressure to fall below the set pressure and remain there for some time, successive steps in the loading sequence will occur at 15-minute intervals. This interval of response is adjustable to suit conditions.

A fast cycle has been built into the control to detect and rectify any rapid increase or decrease in gas pressure. This response is actuated by limits surrounding the dead zone and will load or unload steps every 15 seconds instead of every 15 minutes.

Overload protection . . . There is a series of combinations of suction and discharge pressures where the horsepower demand will exceed the rated horsepower of the motors. To avoid overloads and subsequent shutdowns, a special wattmeter controller has been incorporated in the control system.

When the horsepower output of the electric motors approaches an overloaded condition, the control will interrupt the normal sequence and unload the compressor in steps as rapidly as required to prevent an overload. Reloading after an unloading step due to an overload will not take place until 1 hour after the unloading step.

The control will automatically check the power input every hour after an unloading step, and if it is safe the next step in the sequence will be loaded. This arrangement prevents a fast cycling of loading and unloading when operating at or near overload conditions.

Emergency-Shutdown Control

The emergency shutdown control is divided into two separate systems (No. 1 and No. 2) and is designed to allow the dehydration plant to remain in operation if at all possible.

Automatic shutdown controls have been installed on individual compressor units. One of the following conditions will stop a compressor. Other compressor units and the dehydration plant continue to operate:

1. Low lubricating-oil pressure.
2. High bearing temperature.
3. Lubricator-drive motor "off."
4. Jacket-water pump motor "off."
5. Ventilator motor "off."
6. Low ventilating pressure.
7. High motor-stator temperature.

Both the No. 1 and No. 2 emergency systems are equipped with manual shutdown stations that accomplish the following actions:

No. 1 system: Stop all compressors, block inlet and outlet pipelines, and vent both suction and discharge headers.

No. 2 system: Shut down the dehydration plant, stop all cooling fans, and actuate the No. 1 system.

No. 1 system . . . The No. 1 emergency-shutdown system has only one automatic-shutdown point. An excessively low pipeline discharge pressure detected on the plant pressure controller will stop the compressor, close the inlet and outlet plant block valves, and vent the suction and discharge headers.

No. 2 system . . . The No. 2 emergency-shutdown system is divided into two branches—one for the dehydration plant and the other for the compressor area. A low-solution flow rate detected by the glycol-solution flow controller or a low level in the glycol surge tank will cause these automatic shutdowns:

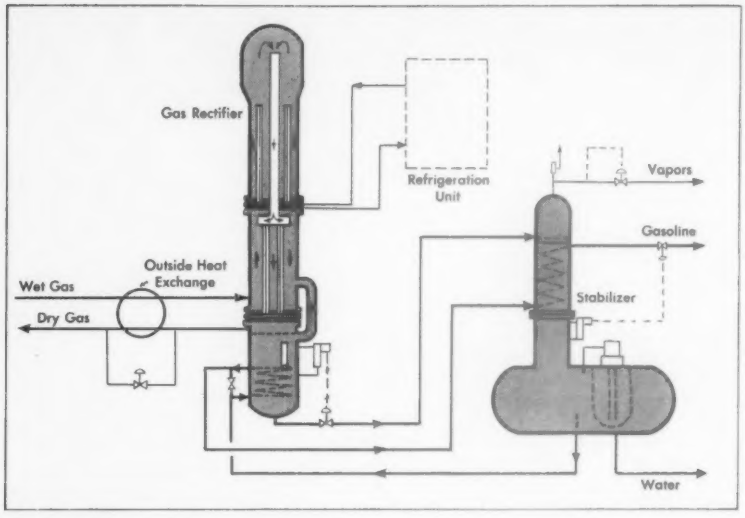
1. Stop the glycol-solution pumps.
2. Shut off fuel gas to the glycol-regeneration unit.
3. Stop the glycol-solution cooler fan.
4. Stop all compressor units.

When the operating temperature of the glycol-regeneration unit is below 350° F. or above 410° F., these automatic shutdowns occur: (1) Fuel gas to regeneration unit is shut off; (2) the glycol-solution cooler fan is stopped; and (3) all compressor units are stopped. The glycol pumps remain on to maintain the circulation of glycol.

There is only one shutdown on the compressor area branch of the No. 2 system. A high liquid level in the inlet scrubber will shut off the compressor units and the fans on the main gas cooler. The dehydration plant will remain in operation when this occurs.

Alarms have been provided on all automatic-shutdown instruments to light an indicator and sound a horn to indicate that trouble has occurred. In addition, instruments operating alarms only are placed at various points in the plant. A horn is sounded and an indicator light is turned on when any of these conditions occur:

1. Low glycol solution flow.
2. Low fluid level in glycol surge tank.
3. High or low glycol-regeneration-unit temperature.
4. High fluid level in inlet scrubber.
5. High or low compressor discharge pressure.
6. High discharge temperature.
7. High fluid level in glycol contactor scrubber section.
8. Low compressor suction pressure.



UNIQUE GAS TREATER removes gasoline and dehydrates small gas streams. By combining a fractionation effect with refrigeration, most of the propane and butanes are excluded from the recovered product. Fig. 1.

New gas treater puts profit in

GASOLINE recovery from small volumes of natural gas has always presented an economic challenge. The problem has become more difficult in recent years with the increase in value of gas and the consequent increased fuel cost for processing to recover liquids.

Let's consider the range of 500 M.c.f.d. at 1.0 to 2.0 gal. per M.c.f. of gasoline up to 5,000 M.c.f.d. at 0.5 gal. per M.c.f. as the range of particular interest. For this range of processing situations, use of the Gas Processing, Inc., gas treater has proved economic and several plants are now in operation.

The unit dehydrates the gas and extracts pentanes and heavier somewhat to the exclusion of butane and propane. Usually a single product of about 20-lb. R.v.p. is made.

Major items of equipment are:

1. The **outside** heat exchanger, consisting of a group of finned tube units.
2. The **inside** heat exchanger consisting of a group of vertical aluminum finned tubes.
3. A **refrigeration chiller** consisting of vertical finned aluminum tubes. The chiller and the inside heat exchanger together form the **gas rectifier** column.
4. A **stabilizer** having an upper packed section and lower reboiler section.
5. A **refrigeration unit** consisting of compressor, air-cooled condenser, and heat-pump equipment.

The components are arranged on a skid in a compact manner. All electric items are constructed as a part of the skid equipment.

Paper presented at CNGA meeting, Los Angeles, 1959.

Wet gas enters the shell side of the outside heat-exchange section and is brought down to a few degrees above hydrate temperature before entering the inside heat-exchange section (Fig. 1). A temperature controller bypasses cold gas around the outside heat exchange and serves to control the wet-gas temperature to prevent hydrate formation in the rather high-velocity, low-cross-section, finned-tube units.

Entering the gas-rectifier column, the wet gas upflows at relatively low velocity around the finned tubes, forming the inside heat-exchange section. After passing over the heat-exchange section, the wet gas continues upward over the refrigeration tubes. The vertical arrangement of the tubes and the temperature gradient established make possible a reasonable degree of fractionation on the wet gas.

Reflux is developed in the relatively low - temperature top section, flows down the outside of the finned tubes, and is stripped of lighter components and enriched in heavier components during its descent. To explain another way, the low-temperature top section prevents the gasoline fractions from leaving the system and the higher-temperature bottom section prevents large pickup of butane and propane in the bottom condensate.

Due to the fractionation effect in this unit, from 10 to 100% more gasoline per unit of refrigeration, depending on composition and pressure, is possible than with conventional refrigeration and partial condensation units. Specifically, where butanes and particularly propane contents are high compared to gasoline content, minimizing the pickup of LPG fractions in the condensate allows marked reduction of refrigeration and other processing facilities.

Dry gas leaving the refrigeration section passes through an enlarged entrainment section, down a conductor pipe and into the finned tubes of the inside heat-exchange section. It then passes through the tubes in the outside heat-exchange section. Temperature approaches of inlet and outlet gas are usually in the range of 3 to 10° F.

Condensate and gasoline flow . . . Raw condensate leaves the bottom of the inside heat-exchange section and flows to a lower compartment of the gas rectifier. Here the temperature is raised by exchange with hot gasoline, or other means, to a point which will prevent freezing at the level controller feeding the stabilizer. About 50% demethanization is accomplished also in the lower compartment.

The raw condensate feeds the top of a packed stabilizer section located above the large reboiler. The reboiler is heated by an electric heater within a salt bath and has auxiliary coils for use of hot gas or steam if desired. Water, originally present in the wet gas, is drawn off of the reboiler or in some subsequent vessel.

Hot gasoline from the reboiler gives up a portion of its heat to the bottom of the gas rectifier and flows upward through a coiled pipe section in the stabilizer column. This flow path accomplishes two purposes; cools the gasoline, and reduces the heat load on the reboiler.

Reboiler heat loads when making gasoline are considerably less than those when operating on raw condensate from conventional refrigeration

small-volume gasoline recovery

units because of the lower propane and butane content. Stabilizer vapors are released through a back-pressure controller to disposal or recompression.

Water vapor and water flow . . . Much of the water vapor entering with the wet gas is condensed in the outside heat exchange and flows directly with the raw condensate into the bottom of the gas rectifier. The remainder of the water vapor upflows with the wet gas and is frozen out as hydrate on the finned tubes. After a while, usually from 4 to 12 hours, the hydrate buildup causes a noticeable reduction of heat-transfer efficiency. At this time a cycle timer switches the refrigeration unit to heat-pump operation and the hydrates are rapidly melted. This "defrost" period usually takes from 8 to 15 minutes. Water is released countercurrent to the wet gas and hydrate on the refrigeration section is melted. Hydrate which is on the heat exchange section is melted by heat transfer from gas warmed up in the refrigeration section.

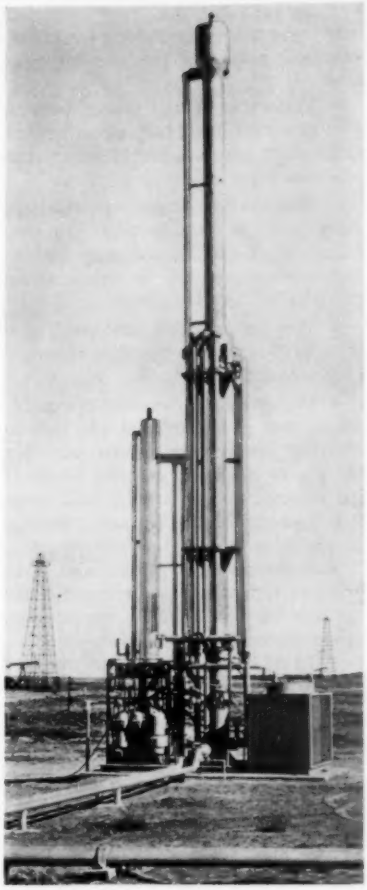
The effect of this heat pump, or reverse-refrigeration process, is such that the top of the gas-rectifier column becomes considerably warmer than the inlet to the column at the bottom. For this reason, water and hydrocarbon dew points during the defrost period correspond approximately to normal column bottom conditions and not to the relatively warm top conditions used during defrost.

Applications . . . The unit was developed in 1957 and designed for unattended operation, use of other than fired heat, no chemical additives, compactness, and production of a specific R.v.p. gasoline rather than raw condensate. Although originally built for the California area, the process has been modified for use in colder areas. The possible uses of the unit have been found to be considerably greater than originally anticipated. Some processing situations, either evaluated or in operation are as follows:

- Cleanup of water and gasoline from gas before entering transmission mains. Here the gasoline yield varies

TABLE 1—GPI GAS-TREATER DATA

	Column 1	2	3	4	5
Model No.	2-75	1-30	2-75	1-250	1-250
Inlet gas volume, M.c.f.d.	2,400	300	2,800	695	990
Operating pressure, psig.	200	450	360	102	285
Inlet gas temperature, °F.	90	90	130	76	83
Inlet gas, gal. per M.c.f.:					
C_3 and C_4's	0.20	2.80	2.30	5.47	3.38
C_5-plus	0.28	0.60	0.45	1.42	0.49
20-lb. R.v.p. gasoline	0.18	0.61	0.30	1.22	0.52
Per cent yield of 20-lb. product in terms of C_5-plus content	64	102	67	86	106



RECENT INSTALLATION of a medium-size treater in a Wyoming field shows compactness of unit. Fig. 2.

BY R. J. HULL

. . . partner in Gas Processing Associates, Fullerton, Calif. He worked with Standard Oil Co. of California for 15 years in refining, engineering, and research. Hull is a graduate of University of California and a director of the California Natural Gasoline Association. He was awarded CNGA's Award for Meritorious Service in 1953.

with content but the chief incentive is to dehydrate and reduce hydrocarbon dew point for transmission reasons.

- Treatment of trap gases produced with crude oil. Here trap gas is treated to produce gasoline for blending into crude or other disposal.
- Gas-well effluent, particularly those rich in butane and propane. Here sales condensate may be increased considerably in many situations by use of the treater.
- Wet-gas injection streams. These may be treated for gasoline recovery and dehydration.
- Wet-gas fuel. Sometimes considerable wet gas is burned for fuel in outlying compressor plants boosting the gas to a distant gasoline plant. If the amount of gas is sufficient, gasoline recovery may be an economic feasibility and operating advantage.
- Boosted tank vapors and low-pressure rich trap gas. Frequently this gas can be processed in the 25-psig. range for economic recovery of gasoline. In this case no separate stibilizer is necessary, the gasoline being stabilized in the bottom of the gas rectifier.

Various models . . . The treater construction is standardized and variables of throughput and operating pressure are usually taken care of by design of the outside heat-exchange system and the rating given to the equipment for a given situation. This versatility is shown in Table 1 which covers a wide range of operating variables.

Referring to the table, Column 1 shows data from a treater operating at relatively low pressure on very lean gas. Note that the total gallons per M.c.f. of propane and butanes is only 0.20. This is pertinent even though only the gasoline components are recovered, because the butane and propane tend to create reflux for heavier-component recovery. In the case of this gas, most of the gasoline fraction was heavier than pentanes; otherwise with the small amount of butane and propane, a lesser gasoline yield would have been realized.

Column 2 data are from a small treater running on average gas at relatively high pressure. Column 3 shows data when processing a rather conventional gas. Normally the yield of 20-lb. gasoline here would be 80 to 100% of the pentanes-plus in the wet gas. In this case, however, the wet gas is quite hot and effective refrigeration capacity is reduced. Columns 4 and 5 are typical of yields and processing variables in the medium and low-pressure range.

A Model 1-250 unit is shown skid mounted in Fig. 2. The gas-rectifier column is on the right and the outside heat exchangers are attached vertically to it. The stabilizer column is on the left. The explosionproof electric starters and control circuit enclosures are at the lower left and the refrigeration unit is on the lower right. The entire unit is on an 8 by 14-ft. skid and the rectifier column is approximately 50 ft. high.

Nelson Refinery Cost Indexes

Published in the first issue each month in the Engineering Section.

Compiled by W. L. Nelson, technical editor and petroleum refinery consultant, Tulsa.

Charts of the indexes are published each year in the late January or early February issue.

Indexes of selected individual items of equipment and materials are also published on the Costimating page in the first issue of the months of January, April, July, and October.

Refinery Construction Cost Index (1946 Basis):

Explained on page 101 of the issue of August 5, 1957.

	1950	1954	1956	1957	1958	Aug. 1959
Pumps, compressors, etc.	138.2	166.5	192.0	206.7	214.7	226.5
Electrical machinery	134.9	160.0	175.0	188.9	192.7	197.7
Internal-combustion engines	126.0	150.5	164.0	173.9	178.3	178.4
Instruments	127.8	154.6	182.1	187.4	194.9	204.1
Heat exchangers	140.0	171.7	190.7	203.6	181.2	177.1
Misc. equipment average	*126.2	160.7	180.5	192.1	192.4	196.8
Materials component	149.5	174.6	190.4	201.9	204.2	207.8
Labor component	144.0	183.3	198.2	208.6	220.4	235.2
Nelson construction index	146.2	179.8	195.3	205.9	213.9	224.2

*Used in computing the Nelson Index until April 1952.

Refinery Operating Cost Indexes (1956 Basis):

Explained on page 171 of the issue of June 1, 1959.

	1946	1952	1954	1957	1958	July 1959
Fuel cost	49.6	81.0	86.5	112.4	102.6	100.5
Labor cost	73.1	88.7	90.9	106.1	105.0	105.4
Wages	52.4	81.5	88.7	104.1	105.4	112.1
Productivity	68.3	90.2	97.1	98.1	100.3	106.3
Investment, maintenance, etc.	51.2	83.6	92.0	105.4	109.5	114.1
Chemicals cost	37.0	72.1	85.7	102.2	104.4	106.1
Operating cost indexes:						
Refinery	58.5	80.5	88.7	106.4	105.9	107.4
Process units†	62.9	82.2	88.4	107.1	105.8	107.5

†Add separate index for chemical, if any are used.

BOOKS

SEPARATION AND PURIFICATION OF MATERIALS. By Rolt Hammond. Published by Philosophical Library, Inc., 15 E. Fortieth Street, New York 16. 327 pp. $10.

This volume covers solid-solid, solid-liquid, solid-gas, liquid-liquid, liquid-gas, and gas-gas systems with a final chapter on separation and purification in nuclear engineering.

From the multiplicity of plant and equipment available, the author has described the main types so that a suitable choice may be made for specific purposes.

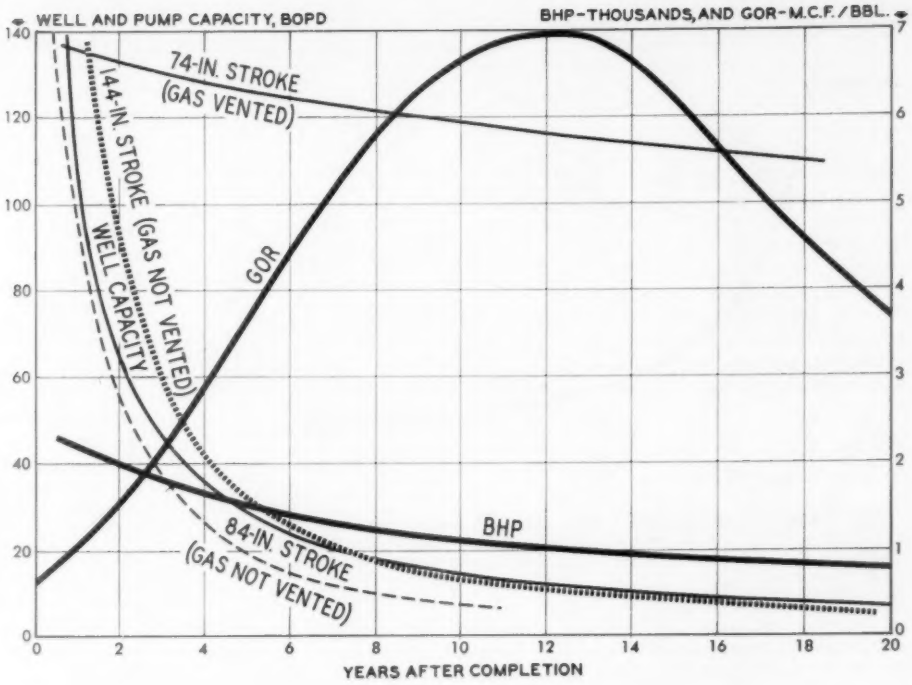
A subject which receives particular attention is atmospheric pollution both by sulfur compounds and by dust.

SCIENCE AND RESOURCES: PROSPECTS AND IMPLICATIONS OF TECHNOLOGICAL ADVANCE. Edited by Henry Jarrett. Published by Johns Hopkins Press, Homewood, Baltimore 18. $5. 250 pp.

This book is a collection of public lectures in review of our present resource situation and expectations.

It covers many fields, and part of one section, exploring for minerals, touches on the petroleum field to some extent.

Note: The Oil and Gas Journal maintains a book department. Write to the READER SERVICE DEPARTMENT, P. O. Box 1260, Tulsa 1, for copies of the book list. Often books reviewed here may be purchased from this source.



FOR greatest economy, pumping units must be matched with well characteristics. The effect of gas interference is shown here. A 74-in. stroke unit will deplete the well if gas is vented. But, if produced gas must go through the pump, a 144-in. stroke unit is required. Fig. 1.

It's easy to overdesign an artificial-lift system. But it's expensive. Use all the available facts; analyze them; then . . .

By **ROBERT W. DRAKE, JR.**
Atlantic Refining Co.

Tailor the lift to the job

THERE ARE USUALLY two or more methods by which any well can be lifted. Proper artificial-lift selection requires an objective economic comparison of all possible methods. Too often one or more methods are eliminated because of prejudice, ignorance, or fear of new or different types of lift. When a well first requires lift, any type lift selected will, of course, show a quick payout; however, a comprehensive study may result in several thousand dollars' savings during its productive life. As it becomes necessary to "pump" from deeper and deeper depths, the necessity for proper lift selection becomes more important.

The production engineer has two goals in the selection of artificial-lift equipment. His primary purpose is to select equipment which will deplete a specific well. His second aim is to select equipment which will result in the most economical depletion. The lift with the cheapest first cost is not necessarily the cheapest to depletion.

Any artificial-lift study must be based on well and reservoir characteristics. The better the reservoir predictions, the better the lift study. In most instances our reservoir engineers have enough data by the time lift is required to give us some "ball-park" predictions.

Assume the first well on a lease requires lift. Some of the things we should know or have a reasonable prediction of are:

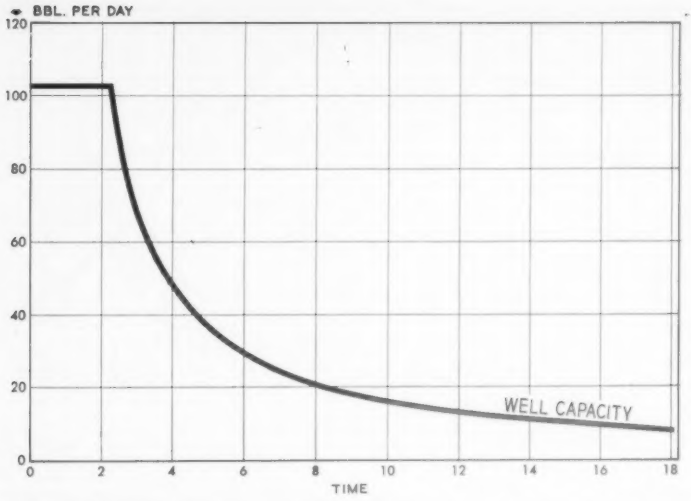
1. Number of wells expected.
2. Reservoir predictions.
3. Availability and cost of high pressure gas.
4. Operating costs of various type lifts.
5. Equipment life.
6. Surplus equipment that may be used.
7. Possibility of consolidation or commingling production.

Often some of this information is sketchy or not available; however, in most instances enough information can be gathered to permit selection of the most economical type of lift.

This discussion is not intended to cover the design of individual artificial-lift installations. Ample data are available from textbooks, technical publications, trade journals, and manufacturers. It should, however, be kept in mind that well capacity and pumping conditions change.

For example: an 8,500-ft. well in a solution-gas reservoir requires lift. We design a pumping installation to lift the allowable from total depth without thought of bottom-hole pressure or decline in productivity. We end up with a pumping unit capable of pump-

Presented at the sixth annual West Texas Oil Lifting short course.



TYPICAL PRODUCTION-DECLINE CURVE used in the calculations in the sample problem. This is only part of the information needed on the reservoir and the individual well to obtain the best pumping-unit design for economic operation. Fig. 2.

ing 150-160 bbl. from 8,500 ft; yet, by the time it is necessary to lift from this depth, well productivity has declined to 30-40 bbl.

By matching the pumping unit with well characteristics it is often possible to use a smaller-size unit. Conversely, disregard of gas-fluid ratio where gas must go through the pump may find us with a 7-ft.-stroke unit where a 12 to 20-ft. or longer stroke is required. For example; 1,000 standard cubic feet of 0.9 specific-gravity gas at reservoir condition of 200° F. and 500 psi. occupies 5.85 bbl. of space. Thus, if the gas-fluid ratio in the pump is 1000/1 we will have to pump approximately 6.85 bbl. to produce 1 bbl. of fluid.

It is, therefore, readily apparent that unless formation gas can be vented, much more pump capacity is required. Fig. 1 shows the effect of gas interference. In this example a 74-in. stroke unit will deplete this well if gas is vented. If gas must go through the pump, a 144-in.-stroke unit is required.

Accurate Cost Data

Inasmuch as we are interested in depleting a well or wells for the lowest cost, we need accurate cost data: initial, replacement, and operating. Initial costs are easy to determine. Need for replacement parts of pumping installation will vary according to the productive life of the well and useful life of the various pieces of equipment. Here we use our own company experience with the same or similar equipment.

Operating costs are sometimes difficult to determine. This is particularly true for a type lift with which we have had little or no operating experience. Published data and manufacturers' representatives can be helpful in estimating operating costs. Also, other operators are usually happy to tell their experience with various types of equipment.

This is not to say that other operators will tell us their actual lifting costs; however, they will in most instances tell their average pump runs, input GOR, etc. This information, coupled with knowledge of our company policy (pumper work load, salary, benefits, etc.), should allow us to determine reasonably accurate operating costs.

Operating costs are usually expressed in cents per barrel. For an economic comparison over an extended period, these costs are better expressed in dollars per well per month. This is because a large portion of the operating costs is fixed and does not decline with production. The exception to this general rule is gas lift. Here the volume of gas may or may not decline as production declines. In a solution-gas drive, gas use should decline, in a water drive, gas use will increase.

Salvage value of equipment after depletion must be considered. In general, only major long-lived pieces of equipment have an appreciable salvage value. Most operators assign equipment a "life expectancy" and depreciate it uniformly during this period. Sucker rods, bottom-hole pumps, gas-lift valves, etc., are usually not assigned a salvage value.

After all our costs have been calculated, we are ready to make an economic comparison. It is theoretically possible to deplete a well with no initial investment but with excessive operating costs; that is by continuous swabbing. It also might be possible to install some type of lift, at a great initial cost, that would have no operating cost.

In order to select the most economical type of lift we need some method to put the initial and operating costs in their proper perspective. The most equitable method is to convert initial and future costs, and salvage values to a present-worth basis. This is done by discounting future costs and salvage value back to the time of initial investment. Interest rate used will vary according to the operator.

Table I shows a hypothetical comparison of various types of lift. The assumed data for this comparison are tabulated as follows:

1. Depth—8,500 ft.
2. Capacity as shown on Fig. 2.
3. Eighteen years "pumping" life.
4. Initial costs

TABLE I—PRESENT-WORTH OPERATING COSTS

Years	Present Worth 8% Factor	Rod Pump	Hyd. Pump	Gas lift			
				Op. Cost	+ Gas Costs	= Total	
1	.9610	$ 1,960	$ 2,306	$ 1,442	$ 4,469	$ 5,911	
2	.8872	1,810	2,129	1,330	2,914	4,244	
3	.8189	1,671	1,965	1,228	1,929	3,157	
4	.7560	1,542	1,814	1,134	1,368	2,502	
5	.6979	1,424	1,675	1,047	1,033	2,080	
6	.6442	1,314	1,546	966	773	1,739	
7	.5947	1,213	1,427	892	642	1,534	
8	.5490	1,120	1,318	824	508	1,332	
9	.5068	1,034	1,216	760	418	1,178	
10	.4678	954	1,123	701	358	1,059	
11	.4318	881	1,036	648	307	955	
12	.3986	813	957	598	261	859	
13	.3680	751	883	552	221	773	
14	.3397	693	815	510	186	696	
15	.3136	640	753	470	154	624	
16	.2895	591	695	434	111	545	
17	.2672	545	641	401	88	489	
18	.2467	503	592	370	68	438	
		$19,459	$22,891	$14,307	+ $15,808	= $30,115	

TABLE 2—INITIAL AND REPLACEMENT COSTS AND SALVAGE VALUES

Year	Item	P. W. factor 8%	Rod pump 1 well	Hydraulic pump 1 well	Hydraulic pump 2 wells	Hydraulic pump 4 wells	Gas lift
0	Initial	1.0000	$20,000	$18,000	$30,000	$48,000	$4,200
7	Replace engine	.5947	892	892	1,487	2,081	.....
13	Replace engine	.3680	552	552	920	1,288	.....
18	Total		$21,444	$19,444	$32,407	$51,369	$4,200
(*)	Less P. W. salvage		—819	—136	—308	—308	.....
	Net cost		$20,625	$19,308	$30,099	$50,061	$4,200
	Net cost per well		$20,625	$19,308	$15,050	$12,515	$4,200

***SALVAGE VALUES**

Pumping unit original cost $8,800 (30-year life)
Remaining lift, 12 years 12/30 ($8,800) = $3,520
Cost to salvage 200
$3,320
P. W. value (.2467 × $3,320) = $ 819

1-well triplex original cost $2,500 (25-year life)
Remaining life, 7 years 7/25 ($2,500) = $ 700
Cost to salvage 150
$ 550
P. W. value (.2467 × $550) = $ 136

2-4 well triplex original cost $5,000
Remaining life, 7 years 7/25 ($5,000) = $1,400
Cost to salvage 150
$1,250
P. W. value (.2467 × $1,250) = $ 308

(a) Rod pumping equipment — $20,000/well
(b) Hydraulic pumping equipment
1 well —$18,000/well
2 wells—$15,000/well
4 wells—$12,000/well
(c) Gas lift—$4,200/well

5. Operating costs
(a) Rod pump— $170/well/month
(b) Hydraulic pump— $200/well/month
(c) Gas lift — $125/well/month plus cost of gas (5c/M.c.f. compression cost)
6. Gas-engine life—6 years
7. Pumping unit life—30 years
8. Triplex life—25 years
9. 8 per cent interest rate.

It is emphasized that these conditions and costs are assumed for illustration only.

The present-worth values for equipment and operating costs (Tables 1 and 2) are then combined to find the over-all costs (Table 3).

Based on this comparison, our indicated selection would be as follows:

1. Lift wells by gas lift if gas available at 5c/M.c.f.
2. If high-pressure gas not available
(a) Lift 1-well lease with rod pump
(b) Lift 2-4-well lease with hydraulic pump

Our final selection will be made after taking into account the following facts:

1. Surplus equipment that may be used.
2. Possibility of consolidation and/or commingling.
3. Time lapse between initial and subsequent lift installations on multiple-well installations.

It is apparent that possession of surplus equipment will materially change our recommendation. Also, a long time lapse between first and later lift requirements on multiple-well leases will require discounting future individual well costs back to time of intial installation. For example: the control plant, a major item in hydraulic pumping, must be installed when the first well requires lift.

TABLE 3

	Rod pump	Hydraulic pump 1 well	Hydraulic pump 2 wells	Hydraulic pump 4 wells	Gas lift
P. W. equipment cost per well	$20,625	$19,308	$15,050	$12,515	$ 4,200
P. W. operating cost per well	19,459	22,891	22,891	22,891	30,115
P. W. total costs per well	$40,184	$42,199	$37,941	$35,306	$34,315

Conclusion

The example covered in this discussion was for singly-completed wells under certain conditions. Dual wells and/or water-drive wells will, of course, be different. In these wells our methods of lift should include dual pumps and submergible electrical pumps; however, the method would be the same.

This selection method may seem tedious and unnecessary to some engineers and production men. This may have been true in the past; but, with deeper pumping and long reservoir life, significant savings can be made by a comprehensive lift study.

BOOKS

OIL PROPERTY EVALUATION, by John M. Campbell. Published by Prentice Hall, 70 Fifth Avenue, New York 11, $12. 523 pp.

This book considers all recent factors playing a part in the evaluation of oil properties. It is a down-to-earth treatment of the elements involved in the establishment of value. With an original approach, this book contains information actually used in the profession, and now appearing for the first time in book form.

The author has divided the book into three basic parts, each substantially self-contained. The first part outlines the general economics of the petroleum industry, forecasting demand trends, dealing with money, and covering the basic tax structure under which the industry operates. The second part deals with petroleum-reservoir problems as they are related to property evaluation. The tools available to the engineer, together with instructions for their use, are covered in detail. The third part explains the preparation of the evaluation itself.

This book is valuable not only to the engineer but also to educators, students, accountants, lawyers and executives.

THE PETROLEUM HANDBOOK. Published by Shell International Petroleum Co., Ltd., No. 1, Kingsway, London, W. C. 2. $3.

This is the fourth edition of a handbook compiled by members of the staff of the companies of the Royal Dutch-Shell group.

The third edition of the handbook was published 11 years ago, in 1948, and many changes have come about in the industry since that time. For this reason, the whole volume has been rewritten to include operations which were not current a dozen years ago.

The section on production includes much up-to-date information, making it more comprehensive that the former editions.

Special color diagrams in the refining section illustrate the text.

Manufacturing and application of petrochemicals are treated in some detail, indicating the new importance gvien these techniques.

One section of the book deals entirely with storage, transportation, and distribution.

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EXCLUSIVE NEW "ACID GUIDE" HELPS YOU

GET BETTER WELLS AT MINIMUM COST

Now—for the first time—a service company has developed a formal, systematic method of engineering acid treatments. The company is Dowell, and the method is the "Acid Guide."*

Using this new approach, your Dowell engineer can help you avoid treatments that are too small to get the results you want, or are unnecessarily large and expensive. He can help you select the right quantity and kind of acid and addition agents, and the preferred injection rate. Also, he can help you predict probable results from the treatment. He can do all these things when he engineers your treatment with the aid of the "Acid Guide." These three examples have been selected to show just some of the ways you may benefit when the "Acid Guide" is used:

NORTH TEXAS. In Wilbarger County, a low-cost acidizing treatment—engineered using the "Acid Guide"—increased production from a show to 12 boph flowing, on a 16/64 inch choke. The well had been completed in the five-foot Canyon lime pay at about 3870 feet. Treatment consisted of a 500-gallon spearhead of BDA* (Breakdown Acid), followed by 2000 gallons Dowell acid injected at five bpm. Results compared favorably with much larger jobs in similar wells.

OKLAHOMA. In McClain County, an operator saved $2000 in treating materials when he had Dowell engineer a treatment with the aid of the "Acid Guide."

The well had been completed into the Hunton lime in a field where the most frequent treatment was 20,000 gallons Retarded Acid (acid-oil emulsion type). The

NEW IDEAS FROM DOWELL

TO HELP YOU MAKE MORE PROFIT

ABRASIJET*

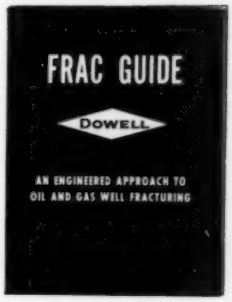
This new Dowell service employs a special multi-jet tool to direct high-velocity streams of abrasive-laden fluid against pipe or formation. The service is used to perforate pipe, reduce breakdown pressures ahead of fracturing or acidizing, and clean or enlarge bore holes. Ask about the other uses operators are finding, also.

CHANNELBAN* BALL SEALERS

These porous ball sealers are made of plastic-coated walnut shells. They resist "pump through" and cannot plug perforations completely. Since they lower the pressure differential between perforations, they reduce the possibility of channeling the cement.

"FRAC GUIDE"*

This recent Dowell development makes possible unusually precise engineering of fracturing treatments. With the aid of the "Frac Guide" it is possible to select the most economical fluid, the correct quantities of fluid and sand, the optimum injection rate. Probable results can also be predicted with relative accuracy.



"Acid Guide" was used to see if desired results could be obtained with a less expensive job.

Calculations indicated that 12,000 gallons of fluid would do as well as 20,000. The actual treatment confirmed this prediction. The well went from one boph, pumping, to 10 boph, flowing. The operator considered this result highly satisfactory.

WEST TEXAS. An experiment was conducted on a well in the Strawn lime of Midland County to check the reliability of predictions made with the aid of the "Acid Guide." After a clean-up treatment using 360 gallons of BDA (Breakdown Acid), the well tested 27 bopd. Calculations made with the aid of the "Acid Guide" indicated that maximum penetration with *regular* acid could be obtained with 2000 gallons. A 2000-gallon treatment increased production to 53 bopd. An additional 4000 gallons of regular acid gave no production increase. Then, additional calculations using the "Acid Guide" indicated that greater penetration and more production would result from a treatment using 12,000 gallons of *Retarded Acid*. Following this last treatment, the well tested 84 bopd.

Ask your Dowell representative to engineer an acid treatment for your well with the aid of the "Acid Guide." For prompt service or detailed information contact the Dowell station nearest you. Dowell has more than 150 offices and stations in the U. S., Canada, Argentina, and Venezuela. Dowell, Tulsa 1, Oklahoma.

*Dowell Trademark

Services for the oil industry

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

How Imperial's compressors cope with

BY D. J. McEACHERN
Imperial Oil Ltd.

IN SOME PARTS of the three western Canadian provinces there is a temperature differential of 165° F. between summer and winter months. These extreme temperatures call for specially designed building foundations, jacket-water coolers, lube-oil systems, and other accessory equipment.

If the proper design precautions are taken, operation in this climate seems to present no special problems.

Conventional design. Compressor stations constructed 6 to 10 years ago or earlier were of conventional design; that is, the compressors were completely housed in a building, and the suction and discharge headers were either inside the building or buried underground outside. The jacket water, lube oil, and compressed gases were all cooled in shell-and-tube water-cooled exchangers. These stations had foundations to depths below the frost line which in most areas means at least 6 ft.

Recent foundations have been the slab type supported by cast-in-place piles to the required depth. (Fig. 1). All buildings were provided with an adequate ventilation system and a method of heating. Most of these stations were manually operated with automatic control being limited to jacket-water temperature.

The cooling towers were of a conventional induced-draft design with the exception of the air-inlet system. As shown in Fig. 2, the inlet louvers were mounted approximately 4 ft. from the edge of the tower. Doors can be installed over the lower section of the louvers in the winter. This prevents ice formation on the louvers from water spray and allows control of the air flow.

All towers were equipped with two-speed reversible fans which allow the operator to reverse the flow of air through the tower to remove ice from the lower sections during extremely low temperatures. All fans on cooling towers have the blade pitch adjusted on a seasonal basis. It is common to carry a 15° pitch in the summer and a 0° pitch in the winter.

New design. During the last 5 years several compressor stations have been installed using air cooling. The initial installations were usually small field booster stations which were allowed to operate unattended. During the winter months some means of controlling the temperature of the air to the coils had to be devised.

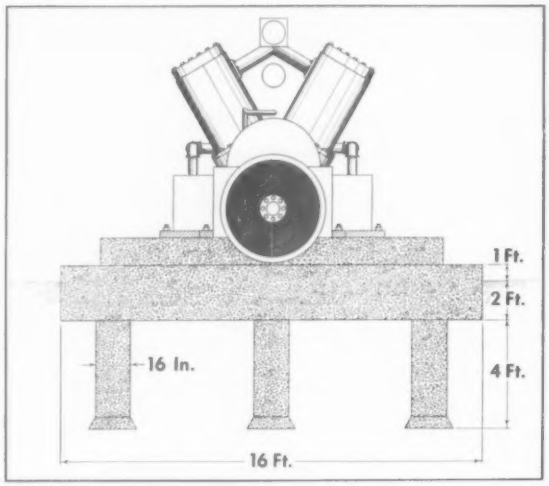
A field booster station in southeastern Saskatchewan is shown in Fig. 3. The air temperature in this building can be controlled by circulating hot air from the front of the radiator back into the building. The radiator is usually set 2 or 3 ft. inside the building to allow for recirculation louvers. The vertical stack on the compressor radiator discharge allows a constant flow of air through the radiator regardless of wind direction. With high winds blowing into the radiator, this type of unit would overheat and shut itself down. The large louvered section in the stack allows for direct discharge of hot air from the radiator during summer months.

Gas-processing plants. Compressor stations located at gas-processing plants have separate aerial coolers rather than having them mounted directly on the compressor skid. A typical aerial cooler of this type is illustrated in Fig. 4. Note the louvers or panels enclosing the lower portion of the cooler. By controlling the quantity of air, radiant heat from the coils will hold the temperature of the incoming air to a minimum of 40° or 50° F. during the winter months. Fig. 5 shows a similar type installation in which the volume of air through the cooler is controlled by louvers mounted above the coils.

In one Alberta field there are eight installations compressing gas for hydrocarbon recovery. At each compressor station, an aerial cooler with a built-in recirculation system for the air was installed. This was the first installation of this type (Fig. 6). The louvers and doors at the top of the cooler allow hot air to be recirculated to the underside of the coils through a specially designed duct to maintain the temperature at 50° F.

It must be kept in mind that it is just as important that these coolers be designed for proper operation in summer as in winter.

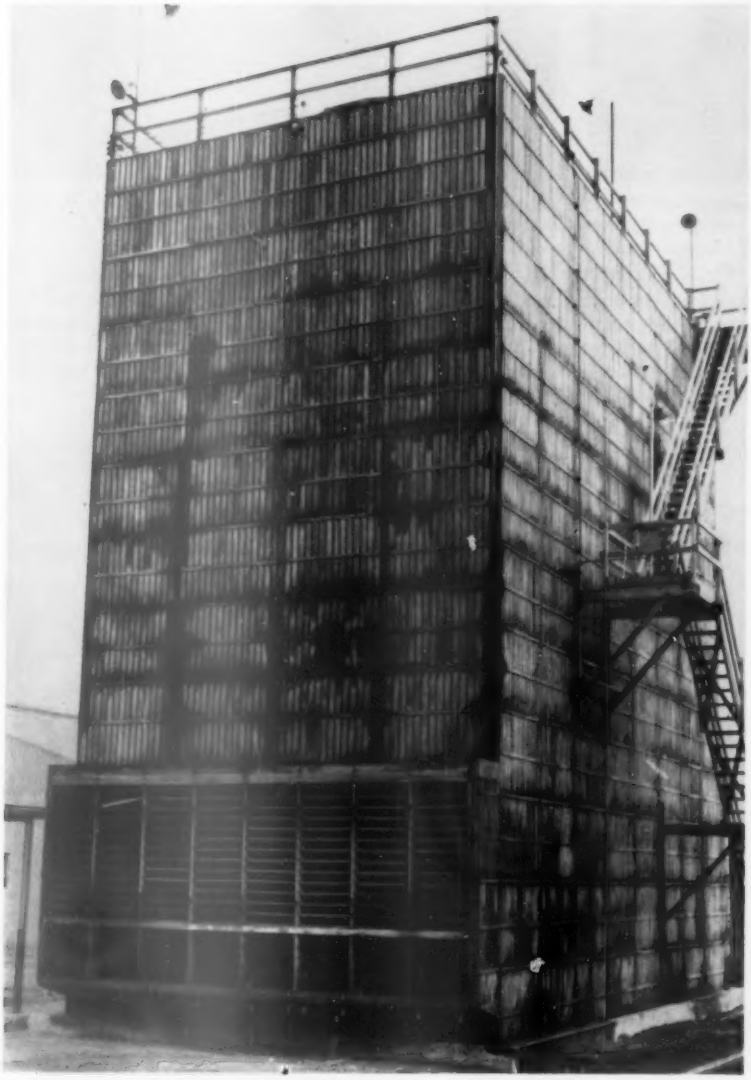
Lube-oil systems on compressors in Canada must be carefully designed so that the oil does not freeze in the cooler and cause a loss of bearings from no oil or overheated oil. If lube oil is circulated directly through an aerial cooler, some means of reestab-



NEWLY DESIGNED compressor foundation for Western Canada is of slab-type construction supported by cast-in-place piles extending below the frost line. Fig. 1.

Presented at CNGA meeting Los Angeles, 1959.

temperature variations of 165° F.

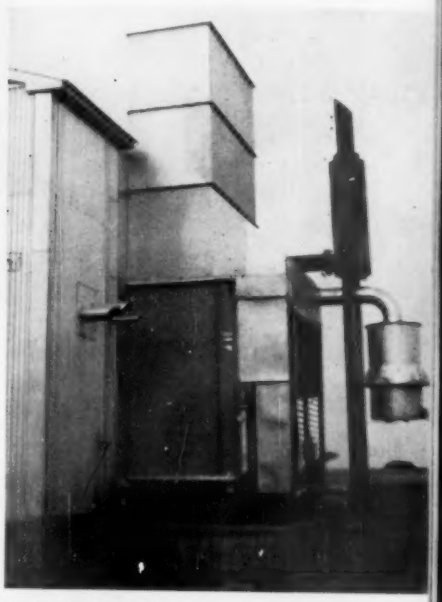


REVERSIBLE FANS provide warm air to remove ice from lower sections of this induced-draft cooling tower in winter months. Also inlet louvers can be covered to control air flow and prevent ice formation. Fig. 2.

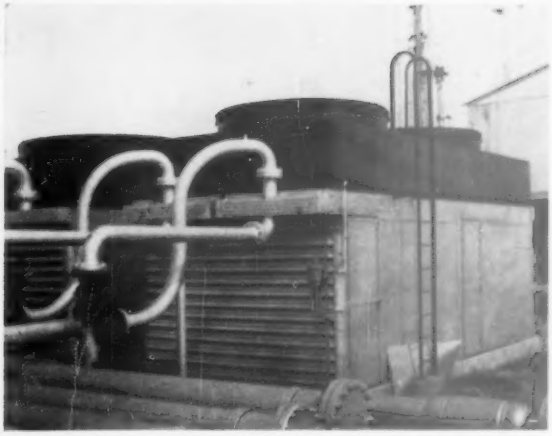
lishing circulation should be provided. This may be done by installing a vacuum breaker on the cooler thus allowing all the oil to drain back into the crankcase of the engine when it is shut down.

When the engine is started the warm oil from the crankcase should be able to maintain circulation through the cooler. In isolated stations where no external source of heat is available, electric heaters are sometimes installed in the crankcase or in the jacket-water system to maintain an engine temperature well above freezing during an extended shutdown. All engines contain an antifreeze solution, usually 50% water and 50% glycol.

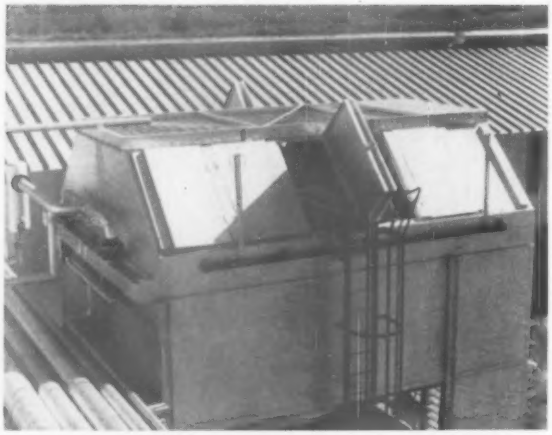
Air intakes and vents from the engine doghouse or other parts of the engine have to be designed to prevent freezing. Oil-bath filters mounted outside of the compressor building are equipped with a bypass that is opened when the temperature gets low enough to cause a large pressure drop through the filter. The formation of hoarfrost



VERTICAL STACK prevents overheating from high winds blowing into radiator. It also includes recirculation louvers to control air temperature in the building. Fig. 3.



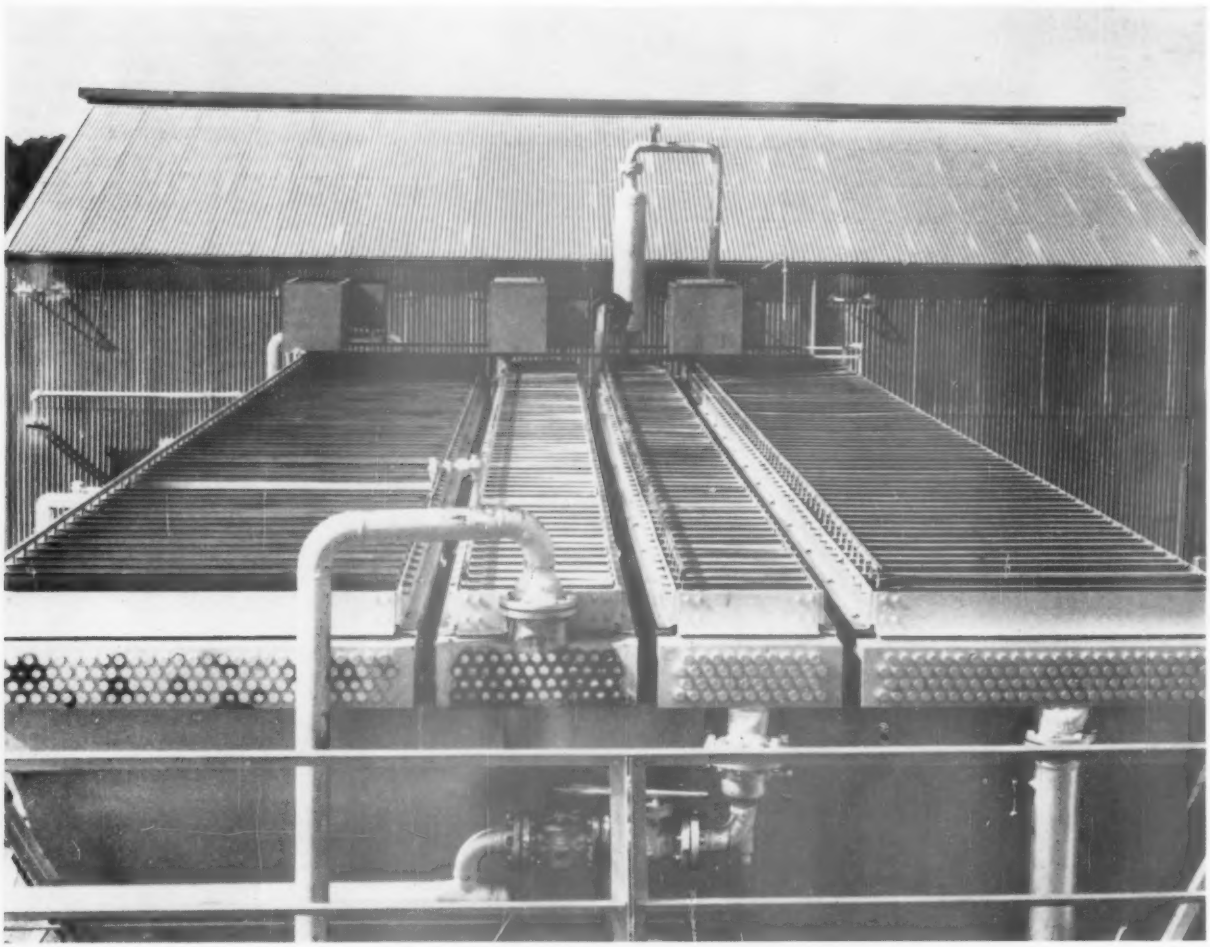
RADIANT HEAT holds temperature to minimum of 40°-50° F. when quantity of air is controlled by louvers enclosing lower portion of this aerial cooler. Fig. 4.



SPECIALLY DESIGNED DUCT SYSTEM recirculates air through this aerial cooler to maintain a temperature of 50° F. Fig. 6.

on the air intake sometimes causes an operating problem.

Maintenance of compressors is no special problem since all installations are suitably housed and heated to allow for comfort of maintenance people during repair periods. Most engines are on a preventive-maintenance schedule which consists of routine monthly checks with major inspections on an annual basis. Compressor manufacturers are now stocking spare parts in western Canada and lengthy shutdowns due to the lack of parts no longer occur.



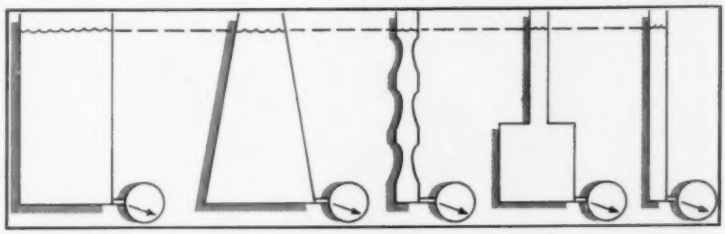
AIR FLOW through this cooler is controlled by louvers mounted above the coils. Fig. 5.

The
FOREMAN'S PAGE

How to determine pressures produced by liquids

ALL FLUIDS (liquids and gases) have weight. Water weighs 62.4 lb. per cu. ft. Air at atmospheric pressure and 60° F. weighs 0.076 lb. per cu. ft. Hydrogen, the lightest gas known, weighs 0.0053 lb. per cu. ft.

Since all fluids have weight they create a pressure against the walls that hold them. The pressure exerted by a liquid at any given point or location in a vessel depends upon the height of liquid above it. This pressure is independent of the shape of the vessel. For example in the vessels in Fig. 4 the pressure gages on the bottom of all vessels would read the same because the height of liquid above the gages is the same.



PRESSURE at any point in a vessel depends on the height of liquid above that point and is independent of the shape of the vessel. These pressure gages all read the same because the height of liquid above the gages is the same. Fig. 4.

Different liquids weigh different amounts for the same volume and therefore will create different pressures. One cubic foot of water weighs 62.4 lb. If this cubic foot of water were put in a box 1 ft. high, 1 ft. wide, and 1 ft. long the total force on the bottom of the box would be 62.4 lb. This total force would be distributed over an area 1 ft. square or 144 sq. in. The pressure on any given square inch would be 62.4 lb. divided by 144 sq. in.; the pressure thus equals 0.433 psi. If the box were 2 ft. high and held 2 cu. ft. of water, the pressure would equal

$$\frac{62.4 \times 2}{144} \text{ or } 0.866 \text{ psi.}$$

Each foot of water height will develop 0.433 psi. For example, if a 100-ft. tower were filled with water, a pressure of 43.3 psi. would be created at the bottom of the tower.

One cubic foot of mercury weighs 840.7 lb. and will build up 5.90 psi. per foot of height. The weight of 1 cu. ft. of material is called the density of that material. The density of water is 62.4 lb. per cu. ft. The density of a substance compared to the density of water is called the specific gravity.

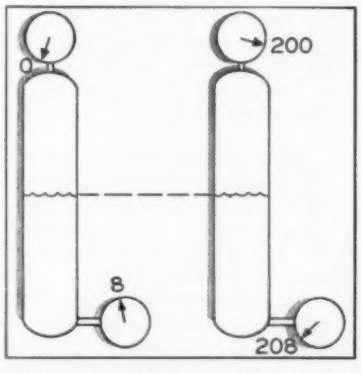
Mercury has a density of 840.7 lb. per cu. ft. and therefore is 13.5 times denser than water. The specific gravity of mercury is therefore 13.5. Gasoline, on the other hand, is lighter than water. Its density is 47 lb. per cu. ft. and its specific gravity is therefore 0.75.

Here are some weights of fluids per cubic foot and the corresponding pressure buildups which will be obtained for each foot of height above the point at which a pressure is determined:

Fluid	Weight per cu. ft. (density)	Specific gravity	Pressure buildups per ft. of height
1. Aerated catalyst in stand pipe	45.0 lb.	0.72	0.305 psi.
2. Water	62.4 lb.	1.0	0.433 psi.
3. Mercury	840.7 lb.	13.5	5.90 psi.
4. Gasoline	47.0 lb.	0.75	0.327 psi.

The final or total pressure exerted at any given point in a vessel, pump, line, etc., will depend upon the height or weight of liquid being handled plus any external pressure being exerted on the liquid. Suppose we had a vessel filled with water to a height of 20 ft., as shown in Fig. 5. If the vessel is open to the atmosphere, the pressure that would be indicated by a pressure gage located at the bottom of the vessel would be 20 × 0.433 or 8.66 psi.

Suppose we close the opening in the vessel and add pressure to the vessel with a compressed gas so that the pressure gage at the top of the vessel reads 200 psi. In order to determine the pressure at the bottom of the vessel we would have to add the pressure produced by the height of water to the pressure produced by the compressed gas. The pressure gage located at the bottom of the vessel would read 208.6 psi.



TO GET the pressure at the bottom of a vessel add the pressure produced by the height of liquid to pressure produced by the compressed gas. Fig. 5.

External pressure can also be exerted on the surface of a liquid in a closed vessel due to the vapor pressure of the liquid. For example, if a 40-ft.-high closed vessel contained 20 ft. of gasoline at 100° F., the resultant pressure at the bottoms would be 18.5 psi. Why this pressure?

Vapor pressure of gasoline at 100° F. = 12 psi.

Pressure due to 12-ft. height of gasoline. 20 ft. x 0.327 psi. = 6.5 psi.
Total pressure 18.5 psi.

This material taken from process-training-program manual, Bayway, N. J., refinery of Esso Standard Oil Co.

MODERN PETROCHEMICAL PROCESS produces acetylene at General Aniline & Film Corp.'s Calvert City, Ky., plant.

Acetylene picture is clearing

- Nearly a dozen methods are available today for the conversion of hydrocarbons to acetylene. These range from the original commercial arc process pioneered in Germany to pilot-plant and commercial development on regenerative cracking and partial combustion of hydrocarbons by American and foreign firms.

BY MARCEL J. P. BOGART
Lummus Co.
New York

ACETYLENE has enjoyed an eminence as a basic building block for chemicals manufacture. This has been particularly true in Europe where the lack of petroleum has required the use of acetylene generated from calcium carbide as a raw material for the production of chemicals. Because of our petroleum economy, acetylene from carbide has not reached such heights as a raw material in the United States. However, there has been much more than a casual interest in new methods of making acetylene, mostly in the use of petroleum hydrocarbons as feed stock.

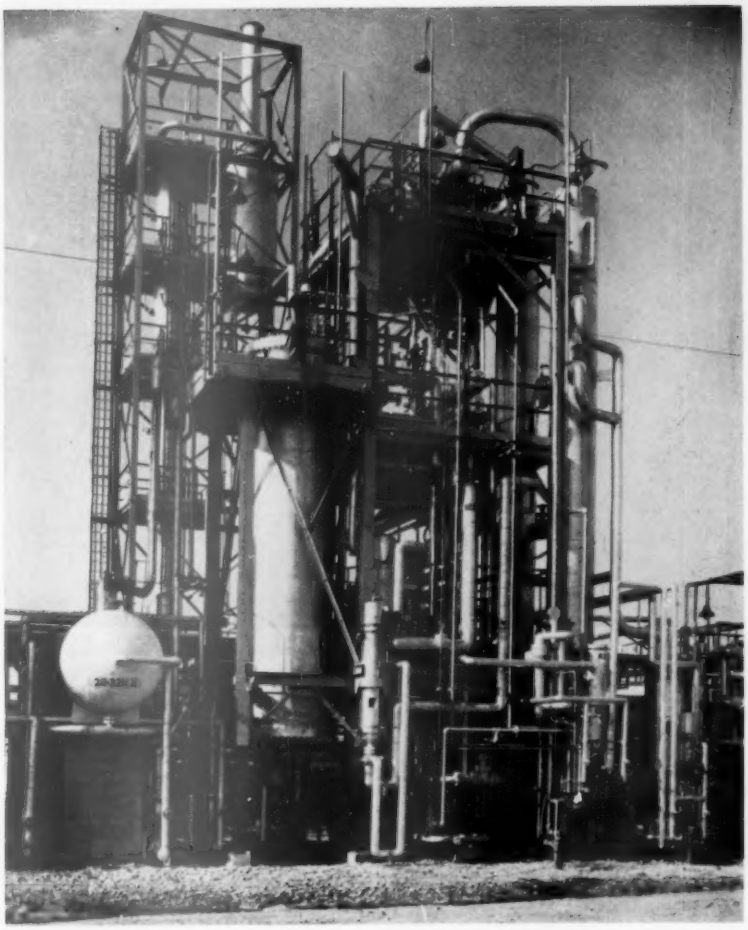
Early in the 1950's, using a process developed in Germany, the American calcium carbide monopoly was broken by the erection of three plants for the conversion of natural gas to acetylene. Since that time other methods have become available to handle a range of feed stocks from methane to heavy oils. A discussion of the over-all requirements and of each factor of the various processing routes is important in selecting a process for the manufacture of acetylene.

Unique properties of acetylene . . . Acetylene is the only hydrocarbon that can be easily derived from inorganic sources—limestone and coke, the raw materials for the manufacture of calcium carbide. It has a very high, positive, free energy of formation, and a heat of formation more than four times that of ethylene. Due to its extreme reactivity and unsaturation, it is the most hazardous of the lower hydrocarbons to handle. This situation closely limits processing conditions of temperature and pressure for acetylenic mixtures.

Because of its reactivity and simplicity of molecular structure, it qualifies as a basic building block for the synthesis of much more complex chemicals. It is also the only hydrocarbon that can be stored as a dry powder—"instant acetylene—just add water and serve."

The Carbide Route

The carbide route has had a strong influence on the development of newer methods and technology. It is by no means an obsolete process today—it accounts for the majority of acetylene manufactured, and still figures prominently in the growth of acetylene production in the United States. This is the route wherein limestone is calcined to lime and reacted with coke in an electric furnace to produce calcium carbide, CaC_2, with carbon monoxide gas as a byproduct. Calcium carbide is a grayish-white powder which is relatively inert, but



EQUIPMENT, including reactors like these, requires large capital expenditures for hydrocarbon-source acetylene plants.

in the presence of water it reacts to produce acetylene and hydrated lime.

The main disadvantage of this route is the large electrical requirements, amounting to about 4 to 5 kw.-hr. per pound of acetylene produced. Developments are still continuing on this process, for example, substituting combustion with oxygen for the electric arc, and continuous furnace operation in place of batch operation with its expensive labor requirement.

The unrelenting expansion and improvement of this process in the United States is proof that it can compete with the newer hydrocarbon routes. Construction of a hydrocarbon-source acetylene plant requires capital expenditures as much as 2 years prior to production. Purchase of carbide can be delayed until it is actually needed.

Calcium carbide as a source material for acetylene then has these important advantages:

- Easily stored and shipped as a powder.
- Purchased "off-the-shelf."
- Consumed on a variable demand schedule.

Hydrocarbon-Synthesis Routes

To get a closer look at acetylene manufacture by the hydrocarbon synthesis routes, it can be divided into two basic operations—cracking and purification. The cracking reaction is highly endothermic and is carried out at temperatures over 2,000° F. The residence times range in the order of 0.003 to 0.01 seconds as, unfortunately, the high temperatures required for the rapid and economical formation of acetylene are close to those temperatures at which it decomposes.

There are at present four commercially feasible methods of meeting such stringent process requirements:

1. Reaction in an apparatus where the energy input is supplied to a hydrocarbon stream by an electric arc.
2. Reaction in a regenerative furnace in a cyclic operation. Necessary thermal energy for the cracking reaction is supplied by burning a suitable fuel gas in a separate and previous portion of the furnace operating cycle.
3. Partial combustion which simultaneously conducts an exothermic reaction to balance out the endothermic requirements. An example is the combustion of a portion of the feed hydrocarbon with air or oxygen.
4. Flame chemistry, wherein the feed stock is injected into the hot combustion products of a fuel less valuable than the feed stock.

Although some of these methods may be limited in application, a few are available to handle the range of commercially attractive feed stocks from methane to vaporizable heavy oils. Nine different licensors have publicized processes for the production of acetylene from petroleum-derived feed stocks. These processes, which are in various stages of commercial development, are those of Badische Anilinund Soda-Fabrik (BASF, formerly "Sachsse"), Chemische Werke Huels, Farbwerke Hoechst A. G., Montecatini, Phillips Petroleum Co., Schoch (University of Texas), Societe Belge de l'Azote (SBA), Tennessee Eastman Corp., Tsutsumi (Japan), and Wulff Process Co. The processes may best be examined according to their methods of operation.

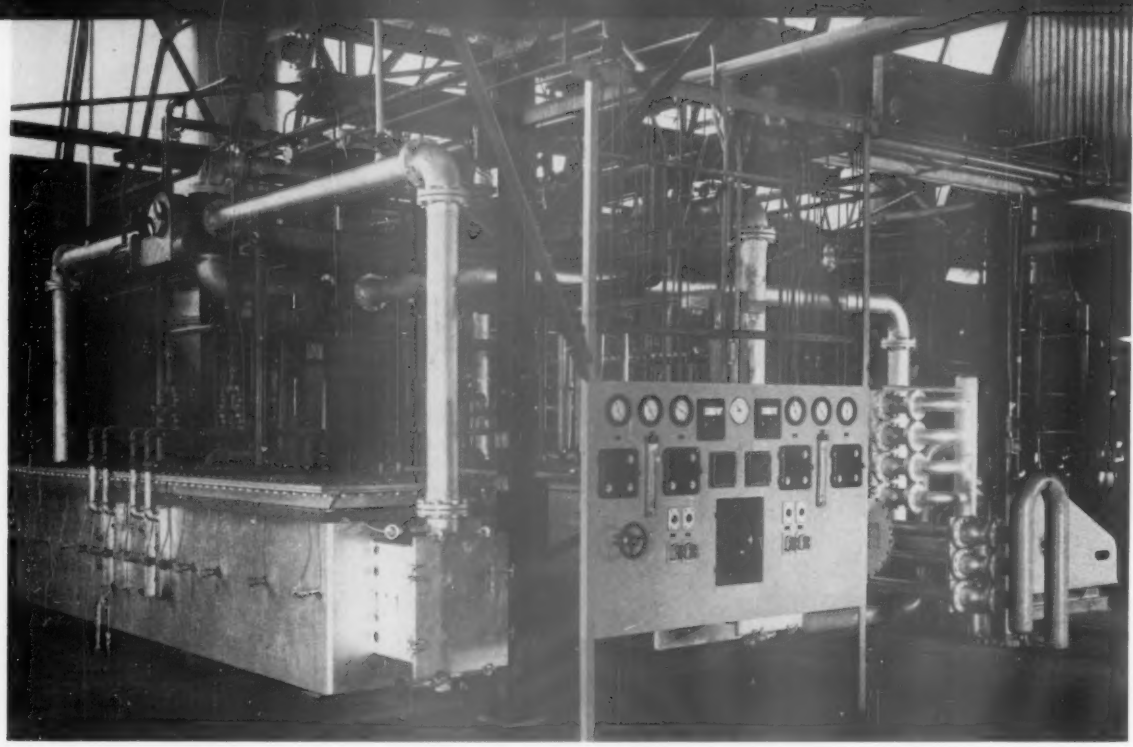
Arc processes . . . The Huels plant in Germany was the world's first large-scale plant for the production of acetylene from hydrocarbons. Here methane is flowed at high velocity through an intense electric arc, producing substantial yields of acetylene and considerable carbon black. The methane raw material in this plant is obtained by low-temperature purification of coke-oven gas.

Esso's recent anonuncement of its acquisition of the Schoch process, which pilot-planted another reaction system for electric-arc cracking of natural gas, indicates that future developments may be forthcoming along this line.

Patents of General Electric Co. and others describe a process to crack liquid hydrocarbons by a submerged electric arc, the feed stock acting as its own quenching medium.

Commercialization of these processes has been forestalled by their large expenditure of electricity (about equal to that for the carbide route) and the high cost of removing and disposing of the carbon black formed.

Regenerative techniques . . . These are best exemplified by the Wulff process, under development for over a quarter-century. The first version used an indirectly heated silica tube which was deemed satisfactory except



THE WULFF REACTOR, above, can handle a wide range of feed stocks from methane to heavy gas oil.

for conversion to large-scale operations. This was followed by experiments where the short residence-time requirement was met by a regenerative technique using readily condensable mercury vapor as diluen . Again, this scheme was found unattractive for scale-up to a commercial unit. The present version of the Wulff process uses steam as the diluent gas in place of mercury vapor, allowing for easy extrapolation to full-scale operations.

This use of steam was once considered not feasible due to the competing reaction between steam and hydrocarbons at temperatures above 1,400° F., forming hydrogen and carbon monoxide. However, it was later found that the velocity of the water-gas reaction was sufficiently less than that of the cracking reaction to give an attractive net yield of acetylene. This led to the use of a combination of vacuum and dilution steam to provide the low residence times needed.

The Wulff reactor is a furnace comprised of a pair of refractory masses separated by a combustion chamber. It operates in a cyclic manner. Heat is first deposited in the refractory checkers by the combustion of any convenient fuel gas. In the next part of the cycle, the cracking stock is passed through the furnace in the opposite direction, withdrawing the heat of cracking from that previously stored in the refractories.

This method suffers from its inability to provide a rapid quench to minimize the decomposition of the just-formed acetylene, but has the important advantage of recovering most of the sensible heat in the cracked gas. It is therefore on a par with competing processes from the standpoint of net hydrocarbon requirements translated as B.t.u.'s.

The Wulff reactor is also economically attractive because of its ability to handle the widest range of feed stock. Everything from methane to heavy gas oil has been successfully cracked in the Wulff pilot plant. The furnace is virtually self-cleaning, as carbon and tar deposits burn off during the combustion part of the cycle. The ability to operate economically without an oxygen plant is also important, particularly for smaller-size commercial plants.

The only installation using this process is that of the licensor in Los Angeles. Here propane has been cracked since 1952 and at present it is producing 1 million pounds per year of acetylene which is bottled and sold for welding gas.

Partial-combustion processes . . . In commercial versions of this process methane or natural gas and a limited quantity of oxygen are separately preheated to over 1,000° F. and then blended intimately in the mixing chamber of the reactor. The mixture is passed through a suitable distributor, and ignited in the reaction chamber. The resulting mixture of cracked and combustion gases is quenched immediately, carbon black removed, and sent to the purification unit. The rapid quench allows the attainment of higher yields than does the Wulff process. There is, however, only partial recovery of the heat in the cracked gas, a more difficult carbon-removal problem, and the necessity of installing an oxygen plant.

The BASF version of this method is the only one in operation today in the United States on a large scale. Plants were built for the pyrolysis of natural gas by this process around 1950 at Texas City, Tex., by Monsanto Chemical Co. and Union Carbide Chemicals Co., and at Fortier, La., by American Cyanamid Co. In 1956 Rohm & Haas Co. joined this group with its Houston installation.

SBA pilot-planted an all-metal, water-cooled reactor for the cracking of natural gas by partial combustion. It exhibited a freedom from refractory failures and carbon buildup which plagued other such reactors. The degree of success of SBA's scale-up of its reactor will be demonstrated when the first commercial plant using this process goes into operation. This plant is being built in Carling, France.

Flame chemistry . . . These processes are characterized by a reactor in which the combustion of residual gas (or a fuel gas of lower value than the hydrocarbon feed stock) provides a high-temperature heat source into which the feed stock is then injected for cracking. The mixture of cracked gas and combustion products is rapidly quenched to fix the acetylene so produced. A choice is presented between air and oxygen for combustion.

With oxygen, the temperature of

THIS NEW ACETYLENE-ETHYLENE PLANT going up at Frankfurt indicates the competition between the new hydrocarbon and older carbide routes for acetylene production in Germany.

the combustion gas may be too high and lead to overcracking, in which case the heat source can be tempered by the addition of low-pressure steam prior to injection of the feed stock. As in the partial-combustion processes, there may be problems in obtaining heat recovery and in removing carbon black from the cracked gas. This route is offered mainly for the use of transportable liquid hydrocarbons as feed.

Farbwerke Hoechst has constructed a plant in Germany to crack light naphtha for an annual production of 30 million pounds of acetylene and 40 million pounds of ethylene. This commercialization of the Hoechst route, known as the high-temperature-pyrolysis (HTP) process, is now undergoing initial operation. Residual gas from the purification unit is burned with oxygen to provide the energy for the cracking reaction. An interesting feature of the HTP process is the use of the same reactor for cracking of methane as for higher hydrocarbons.

Also of interest is the work done by Phillips Petroleum Co. on this process. The tangential reactor designed by Phillips for making carbon black operates under conditions more rigorous than even those dictated by acetylene-synthesis conditions. It is reported that tests made under reduced severity gave good yields of acetylene and, surprisingly, little or no carbon black. Further work led to the announcement of the process to crack methane and higher hydrocarbons for acetylene manufacture.

Tennessee Eastman Co. and SBA have also reported extensive experimental work on this route. It has been announced that Huels has undertaken commercial development of the Tennessee Eastman reactor to supplement its production from electric-arc cracking. A process developed by Professor Tsutsumi has been announced in Japan, and it is claimed to be excellent for making acetylene from stocks as heavy as black oil. Further details on the Tsutsumi process are awaited.

Cracked-Gas Purification

Pyrolysis of methane or dry natural gas results in a cracked gas that is predominantly a mixture of H_2, N_2, CO, CO_2, unreacted methane, and acetylene. It is contaminated by higher homologs of acetylene, the most objectionable of which are methyl acetylene, vinyl acetylenes, and diacetylene. Use of higher hydrocarbons as charge stock will add olefins such as ethylene, propylene, propadiene and butadiene, aromatics including benzene and naphthalene, plus miscellaneous higher hydrocarbons and tars. An acetylene content of 4 to 15 vol. % is common in such mixtures.

The common standard of "pure" acetylene has been that produced from calcium carbide, where the product is scrubbed with such common reagents as sulfuric acid and caustic soda to remove the known inorganic impurities (mainly sulfur, arsines, and phosphines). Acetylene from the pyrolysis of hydrocarbons has been looked on as a different "breed of cat" due to its content of such strange and unfamiliar impurities as propadiene, methyl and vinyl acetylenes, diacetylene, etc.

Those unacquainted with the use of this hydrocarbon-derived acetylene are unable to set reasonable limits for these impurities, and often conservatively insist that they be "entirely" removed. Surprisingly, a mass spectrographic analysis of so-called "pure" acetylene gas generated from European calcium carbide indicated that it too contained virtually all these very same impurities and in like amounts.

Decomposition and detonation studies on acetylelne and its mixture with other gases indicate it is seldom safe to operate under conditions where the partial pressure of acetylene exceeds 1 to 2 atm. A similar upper limit exists on temperature (200° to 220° F.). A lower temperature limit also exists, since it is hazardous to operate with any significant inventories of liquid or solid acetylene. These upper limits and the triple point of acetylene at 18.5 psia. and −113° F. (−81° C.) leave little room for maneuvering. These are much more restrictive barriers than those faced in the purification of any nonacetylenic hydrocarbon.

Solvent absorption . . . In the presence of these taboos it is not surprising to find that nearly all proposed acetylene-purification processes are based on absorption in a selective solvent. The patent and technical literature is bulging with prospective solvents, but operation on a pilot or commercial scale has tested but a few of these: water, anhydrous ammonia, acetone, methanol, dimethyl formamide, butyrolactone, n-methyl pyrrolidone, hydrocarbon fractions, and acetonyl acetone.

"Hydrocarbon raw materials represent half the cost of acetylene manufacture."

The ever-growing list of patents on potential solvents indicates the intense interest in this broad problem. They exploit, of course, the individual attributes of these solvents. For example, the cheapness of water allows its use on a once-through basis and minimizes or eliminates solvent-regeneration problems. Ammonia is unique since its boiling point is between that of acetylene and its next higher homolog (methyl acetylene), making light work of what is usually a tough separation. Furthermore, it is possible to refrigerate ammonia-acetylene solutions directly by evaporating a portion of the ammonia. Other solvents rely on superior capacity or selectivity in one or another of the various separation steps involved.

Choosing among various solvents requires consideration of a number of factors. Neither the cracking process used nor the scale of operation is particularly significant here. However, the end use, or purity requirement, of the product acetylene, and the nature and quantity of the byproducts to be recovered and purified, are of major importance. The character of the feed stock and its potential use in one or another of the purification steps may influence the final choice, as will the drawbacks exhibited by a given solvent. Examples of these disadvantages are:

1. Increased recovery and regeneration problems of the costlier solvents to minimize losses.

2. Necessity for removing CO_2 in the presence of acetylene when using ammonia as the solvent.

3. Problem of drying acetylene gases when using solvents requiring low temperatures to prevent hydrate formation, or using solvents that may hydrolyze at elevated temperatures, leading to equipment corrosion and loss of valuable material.

Adsorption . . . It is reported that Tennessee Eastman's acetylene pilot plant has used continuous charcoal adsorption (in a Hypersorber) for the key separation step. To prevent loss of adsorbent activity through gradual accumulation and polymerization of the higher olefins and acetylenes, it is necessary to remove them by pretreating the Hypersorber feed. The Hypersorber is then used to make the C_1/C_2 and C_2/C_3 separations. The C_2 fraction so isolated will then be a mixture of acetylene and ethylene (and ethane, if present) with some CO_2. Further resolution of this C_2 cut is made by a selective solvent.

Byproducts

Any process is enhanced when the inevitable byproducts can be recovered and disposed of profitably. In the production of acetylene from hydrocarbons it is then desirable to use purification methods which will convert the other constituents of the cracked gas to something of greater than fuel value.

BASF plants in the United States segregate the hydrogen and carbon monoxide content of the cracked gas for use as raw material in the synthesis of ammonia or methanol. Plants cracking higher hydrocarbons may, in addition, provide for the recovery and purification of ethylene as a coproduct. Because of its smaller quantity and greater difficulty of purification, the C_3+ material is generally collected en masse and disposed of by recycling it to the cracking step or to fuel.

Economics

When the struggle for survival among the various process routes subsides, it is expected that the investment costs of an acetylene plant for the victorious routes (including carbide) will not differ greatly. The selling price of acetylene from calcium carbide is relatively stable today and is reported to be in the range of 11 to 14 cents per pound. This price depends on geographical location, which affects both the cost of electricity in the manufacturing step and freight in the shipment of the carbide.

Obviously, a hydrocarbon route must be more than just competitive to get established in the United States. Studies indicate that the largest single item of cost in the manufacture of acetylene may be that for the hydrocarbon raw materials. This may represent as high as half the total manufacturing costs, pointing to the need for solving the raw-material supply problem while selecting the processing route.

Tonnage uses of acetylene in the U. S. today are:

1. Neoprene. This involves the dimerization of acetylene to monovinyl acetylene (C_4H_4), followed by chlorination and polymerization to a chloroprene polymer. This route exhibits a steady, normal growth.

2. Vinyl chloride. Here advantage is often taken of the presence of unwanted byproduct hydrogen chloride from other operations. It is reacted mole for mole with acetylene to produce vinyl chloride monomer, which is subsequently polymerized with itself, or to copolymers. The economics of this process often depend strongly on a source of cheap or waste hydrogen chloride and a highly competitive plastics industry.

3. Acrylonitrile. This has been made mainly by the reaction of acetylene with hydrogen cyanide. It is polymerized on a large scale for the production of resins and synthetic fibers.

4. Trichlorethylene. This important degreasing and dry-cleaning solvent can be made by the chlorination of acetylene, with one mole of hydrogen chloride formed as a byproduct.

5. Vinyl acetate. The reaction of acetylene with acetic acid (which can also be derived from acetylene) leads to the formation of monomeric vinyl acetate. This product is then polymerized to polyvinyl acetate, which can in turn be hydrolyzed to polyvinyl alcohol. These are important ingredients for synthetic fibers and the new, glamorous water-base paints.

There are other uses of acetylene which are of secondary importance to large-scale acetylene producers because of the lower quantity requirements of acetylene. Among these are derivatives from high-pressure Reppe acetylene chemistry, such as propargyl alcohol, butynedial, the pyrrolidones, butyraolactone, etc. These generally have not yet generated a sufficient demand to justify an acetylene plant for their production alone.

Competition From Ethylene

Vinyl chloride can also be made by reacting ethylene with chlorine to produce dichlorethane which is thermally dehydrochlorinated to vinyl chloride and hydrogen chloride. Commercialization is around the corner on the direct conversion of ethylene to acetaldehyde which may then be converted to various important chemicals, including acrylonitrile. Acrylonitrile will now also be made from propylene and ammonia, in two recently announced plants.

Since ethylene is being made in the United States at less than one-half the price per pound of acetylene, a significant share of the tonnage use of acetylene may be taken over by ethylene in the future. Germany, the leading pioneer of acetylene as a basic chemical building block, is now exhibiting a preference for the ethylene route as petroleum hydrocarbons become more and more abundant in that country. Acetylene thus faces the danger of yielding some of its eminence to more potent competitors, principally ethylene.

BY W. L. NELSON
Technical Editor and Petroleum Consultant

Questions on TECHNOLOGY

Char value or wick char of kerosine

What is the wick char test that we sometimes see as a kerosine specification? R.T.V.

In the kerosine-burning test (IP 10) of the Institute of Petroleum (26 Portland Place, London, W.I.), the end of the wick is removed after conducting the burning test, the char is picked and scraped from the wick, bits of fluffy fiber are removed insofar as possible, and the char is weighed as milligrams per liter. This is called the char value or the wick char. Details of the test are available in Standard Methods for Testing Petroleum and Its Products, of the Institute of Petroleum. Development of the test is described by J. S. Jackson in the Proceedings of the World Petroleum Congress, Vol. 2, page 699, 1933.

TABLE 1—CHAR VALUES OF A FEW KEROSINES (UNTREATED)

°F.	Wick char, mg./l.	Smoke point, mm.
Cabimas, Vene.		
284-526	140	18
310-482	80	19
375-482	700	18
Las Cruces/Los Manueles		
284-526	100	24
310-482	120	25
375-482	260	24
Mara, Vene.		
284-526	9	26
310-482	18	25
375-482	18	26
Paconsib, Vene.		
284-526	8	27
310-526	16	27
375-482	14	27
San Joaquin, Vene.		
284-526	87	19
310-526	92	17
375-482	117	19
West Tara, Vene.		
284-526	1	27
310-526	4	25
375-482	1	27
Seria (light), Sarnak		
284-526	15	17
310-526	40	15
375-482	55	16
Kirkuk, Iraq		
284-526	11	27
310-526	20	25
375-482	14	26
Qatar		
284-482	7	26
284-526	9	25
375-482	8	27
Kirkuk/Ain Zalah		
284-526	30	25
310-482	17	26
375-482	18	26
Agha Jari, Iran		
284-526	14	23
310-482	10	24
375-482	11	24

TABLE 2—CHAR VALUES AND SMOKE POINTS OF KUWAIT KEROSINES

Boiling range, °F.	Char Values, mg./l. Raw	Doctor treated	Copper treated	Bauxite treated	Acid treated
313-460	14.1	10.6	13.6	...	...
334-479	...	...	20.0	17	...
345-537	...	...	...	...	32.1
	Smoke Points, mm.				
313-460	25	25	28	...	...
334-479	26	...	27	26	...
345-537	23	...	...	...	24

The test is not used extensively in the United States and hence not much information is available to this department. Scant data on the kerosines from a few crude oils are shown in Table 1. Sanctis et al., in their "The Importance of Hydrodesulfurization in the Processing Economy of a European Refinery" (Fifth World Pet. Congress, N. Y., 1959), indicate that conventional Middle East kerosines sweetened with copper chloride, plumbite, hypochlorite, etc., have a char value of 20 or more, whereas by hydrodesulfurization a char value of 9 mg./l. is possible. Sibucara, Venezuela, treated kerosines have the following char values:

	Char	Smoke
302°-482° F.	12	27
302°-526° F.	15	26
346°-482° F.	12	26
346°-526° F.	17	25

One would expect a clear relationship between smoke point and char value, but the data available here do not substantiate such a relationship. Note especially the Cabimas kerosines of Table 1 which have char values far higher than other kerosine of similar smoke points (San Joaquin and Seria, Sarawak). West Tara kerosines have much lower char values (only 1-4) than other kerosines of similar smoke points. Finally in Table 2, acid treating increases (slightly) the smoke point of Kuwait kerosine but decreases the char value.

References to questions on wax

Have you a listing of the wax content for various crude oils of the world, similar to the sulfur-content lists that you have published? E.J.B.

Information on the amount of wax in crude oils is scarce, and the meaning of some of the literature is not clear because of the use of many different methods of analysis, some of which are of questionable accuracy. Accordingly, no complete tabulation or comparison can be made. However, the wax contents of very many crude oils were published in Questions on Technology numbers 3 and 4 listed below:

1. March 29, 1954, p. 131: "Effect of Dewaxing on Viscosity Index" (or see Petroleum Refinery Engineering, 4th Ed., p. 162, McGraw-Hill Book Co., 1958).

2. Jan. 31, 1955, p. 269: "Pour Points of Petroleum Stocks" (also see Petroleum Refinery Engineering, 4th Ed., p. 139, McGraw-Hill Book Co., 1958).

3. Feb. 7, 1955, p. 127: "Wax Content of Crude Oils, U. S. A. and Venezuela."

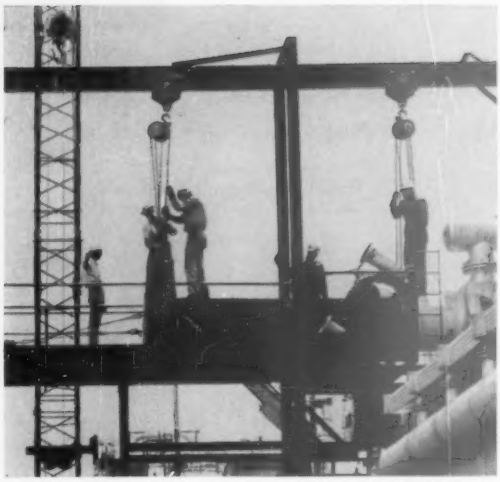
4. Feb. 14, 1955, p. 129: "Wax Content of Crude Oils, Miscellaneous."

5. July 18, 1955, p. 113: "Wax Content versus Pour Point."

6. Aug. 1, 1955, p. 117: "Wax Point of Crudes."

7. Dec. 16, 1957, p. 131: "Wax Content of Lube Stocks."

The last (No. 7) reference could be used to approximate the paraffin wax content of the 700°-900° F. fraction of crude oils if the characterization factors of the crude oil at 550° and 750° F. were available. However, the results would be useful only as a means of comparison.



THE OLD. Contract crew pulling bundle preparatory to cleaning. The job formerly took 8 to 10 men 3 to 4 hours to complete.

AND THE NEW. Power-driven portable mechanical tube-bundle extractor can be handled by a yard crane to remove bundle from its shell . . .

Tube extractor has a lot of PULL

Its muscles make tough refinery maintenance job a lot easier

. . . then gently lower it to ground with a minimum effort. The operation requires only three men and a crane operator.

HEAT-EXCHANGER maintenance, always a troublesome, expensive job, has a new helper at Standard Oil Co. of Texas' refinery at El Paso.

It's a portable power-driven tube-bundle extractor. Called the Model I Postlewaite Exchanger Puller, it's a light welded apparatus that can be hung from an ordinary yard crane.

The apparatus can boost 36-in. tube bundles as high as 60 ft. in the air and has enough muscle power to wrench even tightly stuck bundles from their shells and lower to ground.

To put the bundle back in it takes three men and a crane operator about 40 minutes. Quite a saving in time when you realize that under older methods pulling and inserting a bundle takes 8 to 10 men 3 or 4 hours to wrap up the job.

Sotex says it adds up to a savings of almost $200 per bundle. It means they can design for fewer, larger heat exchangers, a significant economy.

Maintenance people were so enthusiastic about the first extractor that they've built another, called the Mark III Postlewaite Extractor. It can handle tube bundles up to 48 in. in diameter and weighing up to 14 tons.

It's now seeing service at the new Irving refinery going up in St. John, New Brunswick, for Standard Oil Co. of California.

The extractor has been licensed for design, manufacture, and exploitation to Southwestern Engineering Co. in Los Angeles.

BY W. L. NELSON, Technical Editor and Petroleum Consultant

COSTimating

Itemized Cost Indexes

THE COST INDEXES may be used to convert prices at any date to prices at other dates by ratios of the cost indexes of the same date. Itemized indexes are published each quarter (first weekly issues of January, April, July, and October). In addition, the Nelson Construction Cost Index is published in the first issue each month of The Oil and Gas Journal.

	1950	1954	1956	1957	1958	Aug. 1959	References*	Index for earlier years (The Oil and Gas Journal) in Costimating and Questions on Technology issues
Operating costs (based on 1956 as 100.0):								
Power, electric, industrial	97.3	¶98.5	100.0	¶101.3	103.7	103.5	Code 541-03	
Fuel, refinery	70.3	86.5	100.0	112.4	102.6	104.1		No. 4—Mar. 17, 1958
Gulf cargoes	78.0	85.9	100.0	123.8	102.9	93.5		No. 4—Mar. 17, 1958
N. Y. barges	76.9	82.6	100.0	112.3	93.0	85.9		No. 4—Mar. 17, 1958
S. Pedro bunkers	65.8	84.3	100.0	129.2	114.6	99.5		No. 4—Mar. 17, 1958
Oklahoma	77.7	62.0	100.0	105.3	66.3	77.8		No. 4—Mar. 17, 1958
Natural gas at wellhead	60.2	88.9	100.0	101.8	119.4	134.1	Code 531-01	
Industrial chemicals	83.3	96.9	100.0	101.9	101.8	102.1	Code 61	No. 58, Oct. 12, 1959
Phosphoric acid	86.7	96.6	100.0	100.9	103.4	103.4	Code 611-07	No. 58, Oct. 12, 1959
Sulfuric acid	80.8	100.0	100.0	100.0	100.0	100.0	Code 611-09	No. 58, Oct. 12, 1959
Ammonia	104.8	103.0	100.0	98.3	103.8	101.8	Code 611-13	No. 58, Oct. 12, 1959
Lime	64.6	92.0	100.0	106.4	104.4	106.8	Code 611-29	No. 58, Oct. 12, 1959
Sodium carbonate	75.5	92.9	100.0	104.3	104.3	104.3	Code 611-65	No. 58, Oct. 12, 1959
Sodium hydroxide	76.3	90.9	100.0	103.6	112.6	115.7	Code 611-69	No. 58, Oct. 12, 1959
Sodium phosphate	87.5	95.5	100.0	101.1	104.6	104.6	Code 611-71	No. 58, Oct. 12, 1959
Furfural	79.0	100.0	100.0	100.0	100.0	100.0	Code 612-63	No. 58, Oct. 12, 1959
MEK, drums	80.0	94.5	100.0	105.2	106.9	103.3	Ch. & E. News	No. 58, Oct. 12, 1959
Phenol	81.3	90.4	100.0	103.2	102.7	95.2	Code 612-83	No. 58, Oct. 12, 1959
TEL	94.1	102.8	100.0	101.5	99.9	100.6	Supplier	No. 58, Oct. 12, 1959
Operating labor (wages)	72.0	88.7	100.0	103.9	105.4	109.1	Employ. & Earn.	No. 55—Nov. 3, 1949
Productivity	85.5	97.1	100.0	98.0	100.3	112.8	Employ. & Earn.	Sept. 24, 1956§
Construction wages (1946 = 100):								
Skilled construction	140.0	174.6	187.3	196.3	205.1	216.9	Eng. News Record	No. 55—Nov. 3, 1949
Common labor	148.1	192.1	209.2	221.0	235.7	253.5	Eng. News Record	No. 55—Nov. 3, 1949
Refinery construction	144.0	183.3	198.2	208.6	220.4	235.2		No. 61—Dec. 15, 1949
Equipment or materials (1946 = 100):								
Arc-welding machinery		158.4	180.2	186.6	193.2	192.7	Code ‡1176	May 2, 1955§
Boilers, tanks, and sheet metal	†136.0	147.3	168.0	176.3	175.1	175.7	Code 1072	Apr. 21, 1952§
Building materials (nonmetallic)	127.0	143.6	154.0	159.9	161.7	163.2	Code 213	No. 22—Mar. 17, 1949
Brick—building	132.5	144.7	159.2	161.3	162.4	166.8	Code 1341	No. 20—Mar. 3, 1949
Brick—fireclay	153.4	193.1	218.1	232.7	238.7	244.5	Code 1342	May 30, 1955§
Castings (foundry products)	152.9	181.1	204.7	220.5	227.2	232.7	Code 1015	No. 46—Sept. 1, 1949
Clay products (structural, etc.)	134.6	159.1	176.9	184.0	187.0	191.8	Code 134	No. 20—Mar. 3, 1949
Concrete—ingredients	125.3	142.1	153.3	159.7	163.2	164.8	Code 132	No. 22—Mar. 17, 1949
Concrete—products	124.4	138.5	144.9	149.0	151.0	152.9	Code 133	
Electrical machinery	134.9	159.9	175.0	¶188.6	192.7	197.7	Code ‡117	May 2, 1955§
Motors and generators	135.0	157.7	169.6	181.2	186.4	185.6	Code ‡1173	No. 31—May 19, 1949
Switchgear		171.2	194.9	¶212.0	218.8	226.4	Code ‡1175	May 2, 1955§
Transformers	131.6	161.9	175.4	188.0	187.3	189.2	Code ‡1174	No. 31—May 19, 1949
Engines (composite)	126.0	150.5	164.0	173.9	178.3	178.4	Code ‡1154	No. 36—June 23, 1949
Exchangers	140.0	¶171.7	¶190.7	203.6	181.2	177.1	Manufacturer	No. 2—Oct. 28, 1948
Copper base		¶190.7	198.8	191.4	168.8	167.2	Manufacturer	
Steel		¶156.8	178.6	213.2	190.0	184.8	Manufacturer	
Fans and blowers	162.9	192.6	222.4	236.1	241.7	244.1	Code 1147	Feb. 17, 1949§
Hand tools	143.2	173.8	200.3	214.3	224.7	230.1	Code 1042	June 27, 1955§
Instruments (composite)	127.8	154.6	182.1	187.4	194.9	204.1	Manufacturer	No. 34—June 9, 1949
Flowmeter (mechanical)	114.0	161.6	203.3	203.3	209.9	219.1	Manufacturer	No. 34—June 9, 1949
Flowmeter (air control)	138.5	179.6	203.9	208.2	216.3	223.5	Manufacturer	No. 34—June 9, 1949
Flowmeter (remote)	135.5	146.5	170.2	171.2	176.4	179.2	Manufacturer	No. 34—June 9, 1949
Potentiometer, 6-point	134.0	167.2	211.8	230.9	240.4	265.0	Manufacturer	No. 34—June 9, 1949
Potentiometer, air control	134.1	150.5	192.3	204.6	212.6	231.6	Manufacturer	No. 34—June 9, 1949
Pressure controller recorder	135.6	166.3	187.1	189.3	200.0	200.0	Manufacturer	No. 34—June 9, 1949
Pressure gage	101.2	108.6	119.2	119.2	119.2	119.2	Manufacturer	No. 34—June 9, 1949
Thermometer (recording)	124.0	152.8	170.2	171.8	179.7	179.7	Manufacturer	No. 34—June 9, 1949
Control valve	133.3	162.0	180.9	187.8	199.3	199.3	Manufacturer	No. 34—June 9, 1949
Lumber (composite)	193.0	197.8	214.5	201.8	198.9	219.7	Code 81	No. 7—Dec. 2, 1948
Southern pine	176.9	181.2	195.0	187.6	184.7	192.7	Code 812	No. 7—Dec. 2, 1948
Other soft woods	230.2	252.7	266.5	257.6	251.2	276.0	Code 813	No. 7—Dec. 2, 1948
Machinery:								
General purposes	136.7	159.9	183.8	196.5	199.6	207.3	Code 114	Feb. 17, 1949§
Construction	140.1	165.9	187.4	199.4	209.6	217.1	Code 112	
Oil field	†135.8	†161.9	†179.3	193.2	192.5	192.8	Code 1151	Oct. 10, 1955§
Paints—prepared	140.0	159.0	169.2	178.1	180.9	180.9	Code 621	May 16, 1955§
Pipe:								
Sewer	120.7	140.1	160.5	168.0	170.1	178.2	Code 1345	No. 22—Mar. 17, 1949
Black iron	160.0	195.0	233.0	256.1	264.8	263.8	Code 1014-56	No. 19—Oct. 15, 1956
Six-inch line	†159.0	200.5	241.2	268.3	276.9	275.9	Code 1014-58	May 4, 1957§
Pumps, air compressors, etc.	138.2	166.5	192.0	206.7	214.7	226.5	Code ‡1141	No. 29—May 5, 1949
Steel (iron and steel)	152.9	179.6	209.0	224.5	228.2	232.2	Code 101	No. 61—Dec. 15, 1949
Steel—finished steel	153.7	187.1	212.4	232.5	240.6	244.6	Code 1014	July 25, 1955§
Plate		187.0	215.9	241.8	252.7	257.4	Code 1014-26	Mar. 4, 1957§
Structural shapes	162.7	193.4	219.1	252.2	262.8	268.5	Code ‡1014-31	No. 18—Feb. 17, 1949
Seamless tubes, 2-2¼ in.	149.5	199.4	235.5	265.4	277.5	285.1	Code 1014-61	Sept. 5, 1955§
Valves and fittings	†135.8	197.1	231.9	243.4	242.7	262.9	Code ‡1149 (10 items)	No. 46—Sept. 1, 1949
Nelson Refinery Construction (1946)	146.2	179.8	195.3	205.9	213.9	224.2		No. 36, Aug. 5, 1957
Nelson Ref. Operation (1956)	72.4	88.7	100.0	107.0	105.9	109.3		No. 2—Mar. 3, 1958
Nelson Ref. Process Oper. (1956)	75.1	88.4	100.0	108.1	105.8	103.7		No. 2—Mar. 3, 1958

*Code refers to the revised index code number of the Bureau of Labor Statistics, U. S. Department of Labor, "Wholesale Prices."

†Estimated base value for 1946.

‡Not exactly the same items as those published before July 7, 1952.

§Questions on Technology, The Oil and Gas Journal. ¶Revised.

On the Job

PIPELINING

PART 1 OF 3 PARTS

Lube-oil tests reveal wear in pipeline compressor engines

BY D. V. KNIEBES
Institute of Gas Technology

A 2-YEAR STUDY of the wear history of 84 pipeline compressor engines in relation to the concentrations of metals in the lubricating oils from these engines has been completed. And it demonstrates the feasibility of using lubricating-oil analyses as a means of detecting increased rate of wear of engine components before their failure in service.

Inexpensive emission spectrographic analyses were used to determine the metal content of the lubricating-oil samples in the parts per million range.

The nondetergent lubricating oils from most of the engines which operated normally during the study contained low concentrations of wear metals. It was, therefore, possible to indicate tentative upper limits for metal concentrations in nondetergent oils from normally operating engines.

However, these limits are applicable only to engines in which oil is well filtered or sufficient new makeup oil is added to keep the wear-metal concentrations down. Other exceptions were found where metal-containing lubricants and sealing compounds entered the oil in trace amounts.

Several instances of abnormal ring and bearing wear which occurred during the test program were indicated by an increase in iron, lead, or tin concentrations in the engine lubricating oil up to several months in advance of the necessary part replacement. Although the highest sensitivity to wear-rate changes is obtained with clean, nondetergent oils, the method is still useful with detergent oils which tend to retain larger amounts of wear metals in suspension.

The information obtained in this study will permit individual pipeline companies to evaluate the merits of lubricating-oil analysis as a preventive-maintenance tool for their own operations. It will also furnish a basic understanding of the methods used to properly interpret the analytical data.

From Institute of Gas Technology Technical Report No. 1 to American Gas Association.

Previous Studies

The use of emission spectrographic analyses of lube oils to detect excessive wear in engines was first reported by McBrian and Atchison in 1950.[1] This investigation showed that increases in the concentration of metals in the lubricating oil of railroad diesel engines were related to excessive engine wear, and that the type of metal in the oil was a good indication of the engine component which was wearing. The spectrograph gave satisfactory and inexpensive measurements of the quantity of each significant metal in an oil in the parts per million range.

Shortly after this study, American Locomotive Co. started a program of analyzing semimonthly oil samples from the crankcases of over 800 diesel locomotive engines operating on 23 railroads. The results of this study were reported in 1952[2,3] and showed that significant reductions in engine-maintenance cost could be realized by ability to detect and replace failing components, particularly bearings, in time to prevent more costly damage.

Interest in possible engine corrosion by lubricating oil led Alco to correlate the average contents of oils from engines not experiencing excessive wear with the brands of oil used.

Table 1 shows the average metal contents of oils from three groups of about 50 engines. Each group used a different brand of lubricating oil. Although the metal concentrations of all those oils were considered low enough to be representative of engines in normal operation, the results of the correlation showed evidence of differing magnitudes of corrosion due to the brand of oil used.

The railroads which participated in the Alco study later installed their own spectrographic laboratories, or had their oil samples analyzed commercially. Now every major railroad is using the spectrograph for lube-oil analysis in its preventive-maintenance program.

Linnard et al.[4] extended the method to stationary engines used in compressor stations and pumping stations of natural-gas and oil lines. Their 1956 report discussed the applicability of the analytical method to this type of engine, and presented selected examples of instances where excessive wear indicated by oil analyses was confirmed by engine inspection.

The use of spectrographic analysis for wear-rate indications has been limited prior to the present study to nondetergent oils. The electron microscope has been used by McBrian[3] to observe the dispersion of additives in detergent oils, and furnishes enough information to be used as a basis for rejection of oils whose additives are not dispersed properly. This technique is not in widespread use because the method of sample preparation and the interpretation of micrographs have not been perfected to permit reproducibility by different operators.

Engines studied . . . Representatives of 11 transmission companies selected 50 engines for the first year's test program.

An additional 19 engines were included in the program by one of the companies, which also assumed the costs for analyzing those oil samples. The engines selected were considered representative of the types usually found in natural-gas-transmission service. All were gas-fueled internal-combustion engines, ranging from 500 to 3,000 hp. Included were 17 engine models from 5 manufacturers, and 28 grades of oil representing the products of 10 refiners were in use in the engines. The engines were located in compressor stations in 13 states roughly bounded by Texas, Arizona, Illinois, and Virginia.

Another reason for the selection of these engines was that experience in their operation indicated that wear difficulties might well be expected during the next year's test program, thereby furnishing information of value to the study.

On the basis of results obtained in

TABLE 1—AVERAGE NORMAL METAL CONTENTS OF DIESEL CRANKCASE SAMPLES AS AFFECTED BY LUBRICATING-OIL BRAND

Lube-Oil Brand	Spectographic Analysis, Parts Per Million					
	Lead	Silicon	Iron	Chromium	Aluminum	Copper
A	2.21	2.63	9.70	1.47	1.32	2.26
B	3.68	2.32	16.71	1.92	1.56	2.05
C	13.50	3.27	27.33	2.59	2.15	2.92

the first year's test program, 60 engines were selected for the second year's program. Twenty-four of these were retained from the original program for further study, either because of abnormal wear during the test period, or because of unusually high oil-contaminant levels for no apparent reason. Sixteen of the sixty were placed on the program by participating companies which assumed the additional analytical costs.

Oil sampling . . . At 1-month intervals 80 g. of lube oil was removed from each engine at a point ahead of the oil filter while the engine was in equilibrium operation.

The sample line on the engine was first purged to insure removal of any accumulated sludge which might otherwise get into the oil sample and produce misleading results. The samples were taken into polystyrene containers, capped immediately to prevent airborne dust contamination, and sent to the Institute of Gas Technology for analysis.

Oil analysis . . . Analysis of each lube-oil sample consisted of:

1. Pentane-insoluble content as specified in ASTM D893-52T.
2. Total acid number as specified in ASTM D974-54T.
3. Concentrations in parts per million of eight elements determined spectrographically by the rotating-platform method.[5]

The oil sample is thoroughly shaken and 15 g. are weighed into a plastic bottle. Three millilitors of internal standard matrix solution, prepared by diluting 1.282 g. of 6% cobalt naphthenate to 500 ml. with pure paraffin oil and adding 500 ml. of 1.4% lithium naphthenate, is then added and the mixture is again shaken to insure good mixing.

Ten drops of this mixture are placed on a disk electrode whose temperature is maintained at 700° F. by a hot plate. The electrode is a high-purity graphite disk, 0.495 in. in diameter, 0.197 in. thick, and has a small rim to minimize liquid overflow. The oil is reduced to a tarlike consistency in a few minutes and is then ready for the spectrograph.

The disk electrode containing the sample is placed in a special holder which is rotated at 16 r.p.m. during the arcing period.

Results . . . Proper interpretation of the analytical data requires individual treatment of each engine. Since bearing, ring, piston, and cylinder metals vary among different types and makes of engines, the major components of the surfaces subject to wear must be noted so the metal found in the lube oil can be related to the surface which is wearing.

In general, the eight elements determined as useful are:

Silicon, a measure of dirt in the oil; it will normally indicate a malfunctioning air cleaner.

Iron, a measure of wear rate in cylinders and liners, and an indication of the general corrosion occurring in the engine.

Chromium, an indication of wear on chromium-plated rings and liners, and the presence of chromate-treated water in the crankcase.

Aluminum, copper, lead, and **tin,** an indication of wear on bearing surfaces. A number of pipeline compressor engines are now using aluminum bearings, and the conventional steel-backed babbitt bearings contain various amounts of copper, lead, and tin. Aluminum is also an indication of wear in engines with aluminum power cylinders.

Boron, an indication of leaks of borax-treated cooling water into the crankcase. Although boron was determined in this study, the information obtained was not applicable, since none of the engines tested used borax-treated water.

Interpretive precautions . . . The accuracy of an emission spectrographic analysis of the type used in this study is about ±20% of the amount present for each component. Concentrations of less than 10 p.p.m. can be determined to about ±1 p.p.m. Much larger errors can occur if the sample analyzed is not representative of the whole crankcase oil. Since only 10 drops of oil are actually analyzed, it is imperative that the sample be kept thoroughly mixed and free of contamination.

Unfortunately, the most careful precautions will not prevent occasional particles of dust, metal, or engine sludge from getting into the final 10 drops of sample. For this reason, a series of analyses should be rechecked in the laboratory. The engines should then be resampled for a confirming analysis before conclusions are drawn regarding wear rates in the engine.

Certain contaminant concentration limits may be useful in determining whether an engine is exceeding a reasonable rate of wear, but these limits must be supplemented by other data to indicate incipient failure of engine components. For example, a significant and consistent increase in concentration level of one or more elements in the oil must be present before excessive wear which will lead to failure is suspected.

A number of situations can occur which invalidate all or a portion of the analytical data for purposes of wear-rate determination. For example, four of the engines in the program were of the old horizontal type with open oil sumps. Airborne contaminants could, therefore, enter the oil and produce high and erratic concentrations of contaminants, thereby making this type of engine unsuitable for a study of this kind.

In addition, the lead content of the oils from a number of engines could not be used as an indicator of wear, since lead-containing sealing compounds were used on inspection doors in contact with the crankcase oils. As a result of the lead being leached from the sealing compounds, the lead content of these oils would vary from 10 to 100 p.p.m., thereby making any lead which may have come from the bearings.

Oil changes will, of course, upset the equilibrium between oil and engine, and from 200 to 1,000 hours of operation are normally required before the contaminant level of the oil returns to its proper value. If abnormal wear is taking place, however, the concentration of the appropriate metal in the oil will usually increase rapidly enough to cause suspicion rather quickly. Oil-filter changes affect the oil in a similar but not so substantial manner.

Detergent oils contain additives for the purpose of retaining sludge and contaminants in suspension in the oil, thereby preventing their collection on component surfaces in the engine. It can, therefore, be anticipated that the contaminant levels in this type of oil will be significantly higher than in a nondetergent type. This factor must also be considered in interpretation of the analytical data.

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1. McBrian, R., and Atchison, L. C., "Rates of Wear in Railroad Diesel Engines," SAE Journal 58, 18-21, July 1950; Sci. Lub. 2, 26, September 1950.
2. Sennstrom, H. R., "How Spectrographic Analysis Controls Diesel Engine Maintenance," Ry. Mech. & Elec. Eng. 126, 65-68, April 1952. Oil Engine & Gas Turbine 20, 94-95, July 1952.
3. "Symposium on Spectrographic Analysis of Diesel Engine Lubricating Oil," 1-76, Schenectady, N. Y.: American Locomotive Co., 1952.
4. Linnard, R. E., Threlkeld, C. B., and Blades, R. T., "Prevention of Destructive Engine Failure by Spectrographic Analysis of Crankcase Oils," Trans. of ASME 79, 709-13, May 1957.
5. Rozsa, J. T., and Zeeb, L. E., "Fast Spectro Method for Trace Determinations in Lube Oils," Petroleum Processing 8, 1708-12, November 1953.

▶ ▶ ▶ New Equipment Section

This week's SHOWCASE features . . .

Remote shutoff

. . . and startup offered by a solenoid-actuated steam regulator now available. The Series 1163 and 1163-F regulator can also be used where automatic safety shutoff and combination pressure and temperature control with an electric signal are needed.

When the solenoid opens, it allows steam to enter the pilot chamber and operate the main valve as a normal pressure regulator. But when the solenoid closes, the steam supply to the pilot is shut off and the main valve closes automatically.

The regulator is available in ductile iron, bronze, and cast iron. It is suited for temperatures up to 500° F. and pressures up to 250 psi. It comes with screwed ends in sizes from ½ to 2 in. and flanged ends in sizes from 2½ to 3 in. Sizes from 2½ to 3 in. sell for about $350. Delivery time: 1 week. Source: **OPW-Jordan, 6013 Wiehe Road, Cincinnati 13.**

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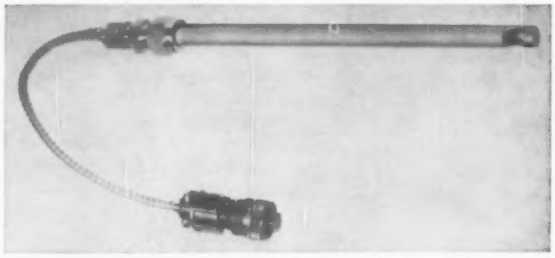


Thermocouple probe for 3,100° F.

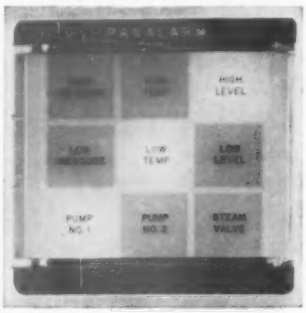
. . . is available with or without water cooling. Made in two types, the thermocouple probe is suited for continuous measurement of furnace and flue-gas temperatures.

According to the maker, the probes are rugged enough to withstand the vibration and temperature conditions existing in afterburning turbojet and ramjet engines, for which they were originally designed, but are now offered for use in industrial applications.

The uncooled Model T-1006-2 probe is made of molybdenum and exhibits extremely high strength at high temperature. To prevent oxidation, its parts are coated with molybdenum disilicide, permitting an operating temperature of 3,100° F. in still air and about 2,900° F. in moving air. The cooled probe, Model T-1006-6, is designed for variable-immersion applications and can be obtained in long lengths. The probes sell for about $550 each. Delivery time is 1 to 2 weeks. Source: **Aero Research Instrument Co., Inc., 315 North Aberdeen Street, Chicago 7.**

Annunciator

. . . easily expanded to provide information and control of industrial process systems. The Panastat annunciator has no moving parts. All operational functions are performed by solid-state elements that are highly derated, the maker says. Low-energy control circuits are used. Ignition in hazardous atmospheres is impossible, the maker claims, as no arc can be sustained.



The annunciator operates on standard a.c. or d.c. line voltages. No transformer power supply is required. Continuous duty is maintained at ±20% nominal voltage. Models of the annunciator system can be expanded easily due to interchangeable plug-in units. It can be used with any alarm system monitoring temperature, pressure, flow, or level producing contact action. To be available in early 1960, the unit will sell for about $25 to $50 per point, depending upon sequence. Source: **Panelit, Inc., 7401 North Hamlin Avenue, Skokie, Ill.**

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ATTENTION ROTARY HOSE USERS

"We have a problem, and it's a big one!"

For the past ten years we have reconditioned GOODALL Rotary Hose here in our Houston plant and, from the reports of the drilling fraternity, saved this branch of the Oil Industry many, many dollars.

We are set up to repair our own hose only—and that's the problem.

Many users of other manufacturers' hose send their hose in for repair and, candidly, it's impossible to do anything with them as our procedure of repair pertains only to GOODALL hose.

We know it's disappointing when you cannot get your hose repaired. A high pressure hose is now a *capital* investment and discarding it is sheer waste. So, we suggest that, before sending in your damaged hose for repair, make sure it's a GOODALL Long-Life Rotary Hose.

Sincerely yours,

Barney

H. Barnard, *President*
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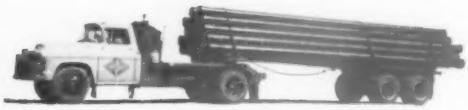
Available through all qualified supply stores.

Congrats and $25 for this quip to CAROLYN KENEDY, Bells Wells Oil Company, Box 269, Miami, Oklahoma.

When it comes to shapeliness . . . Lone Star pipe proportions are right! All dimensions and qualities are strictly API specifications.

Lone Star Steel . . . America's most modern pipe plant . . . is Joe Roughneck's solid source of supply. Right here in the center of the oil country . . . quick availability of Lone Star pipe is a terrific convenience.

Neighbor, wherever you are, specify Lone Star and we both get a good deal.



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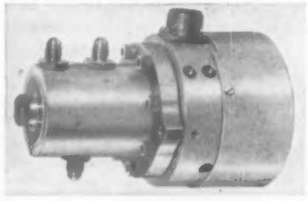
SHOWCASE . . .

New Equipment

Thermocouple wire

. . . takes shock and vibration, the maker claims. The new type of insulated thermocouple wire, called Insupack, is conventionally insulated and sheathed in metal tubing. It's made in all base-metal calibrations in single and duplex pairs. The maker's standard wire diameters are ⅛, 3/16, and ¼ in. with a choice of insulations. Sheaths include copper, stainless steel, and Inconel.

The wire can be fabricated easily on the job for use as a thermocouple element or as extension wire. The metal sheath serves two purposes. It provides mechanical protection. And it lets you use the wire at temperatures above the continuous temperature rating specified for identical insulations without sheaths. Lengths to 50 ft. can be obtained. Delivery time: 1 week. Price: about $1 to $2.50 a ft. Source: **Pyrometer Co. of America, Inc., Penndel, Pa.**



Pressure controlled

. . . automatically for testing and calibrating units or in penumatic control systems with a new pneumatic regulator. The remotely controlled Model

SHOWCASE . . .

New Equipment

RV-23E regulator has built-in safety features in the event outlet pressure exceeds the desired set pressure. First is a relief valve that automatically cracks open when the pressure in the outlet line exceeds set pressure by 5% maximum and reseats when pressure is reduced to 95% of set regulated pressure. Second is an externally adjustable pressure-limit valve that opens at a predetermined maximum desired outlet pressure.

The third feature is a normally open solenoid-operated emergency vent valve wired to a button on the control panel. In the event of electrical failure, the outlet pressure vents down automatically. Outlet pressure range for the regulator is 50 to 4,000 psi. Inlet pressure range is 250 to 4,500 psi. Source: **Marotta Valve Corp., Boonton Avenue, Boonton, N. J.**

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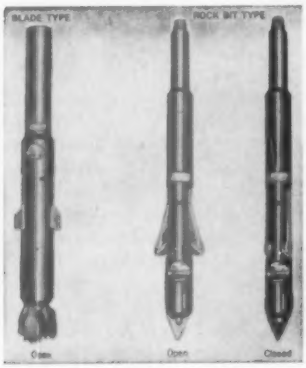
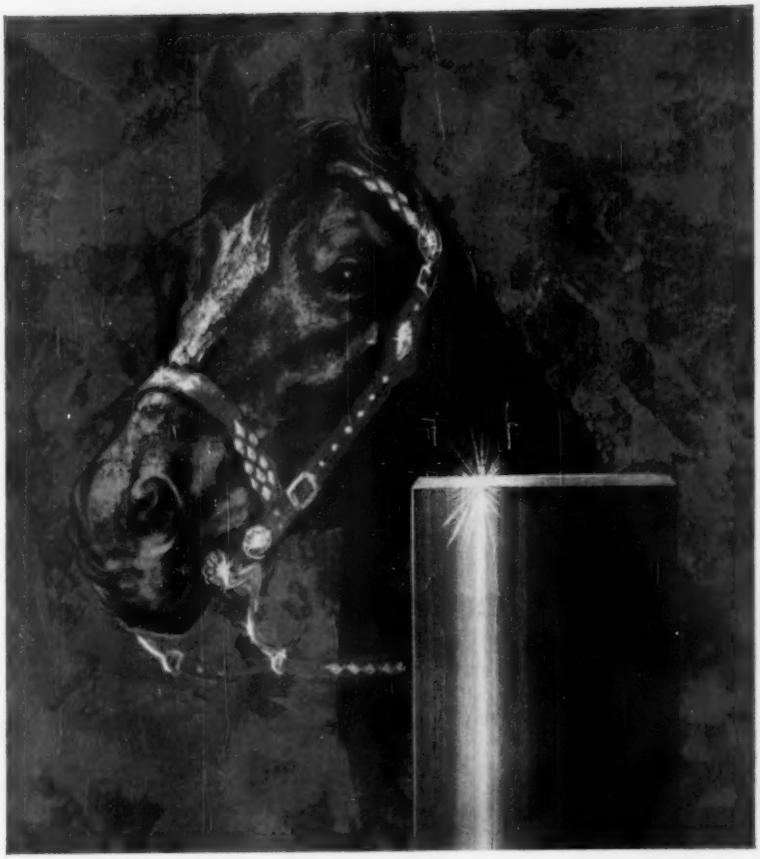


Holes enlarged

. . . through casing with the Servco expanding hole opener now available in both rock-bit and blade types. It promises to be useful for such subsequent operations as gravel packing, cementing, landing casing or liners, wall scraping, and similar purposes where a larger hole diameter is desired.

The rock-bit type can be used to enlarge the drilled hole up to twice the drilled diameter in soft or hard formations. It drills in the same manner as a rock bit. The blade type can be used to open the drilled hole to a larger diameter simultaneously with the drilling operation in soft to medium-hard formations. Full fluid flow passes through the jets of standard bits. None is bypassed. Hole size can be increased to about one-fourth greater than that of the drilled hole. Source: **Servco Co., 2440 Cerritos Avenue, Long Beach 6, Calif.**



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Lone Star pipe, a real thoroughbred, is the odds-on favorite in the oil and gas industry. Precisely made by proud craftsmen . . . Lone Star casing, tubing and line pipe meet exacting API standards.

Strictly a quality product . . . Lone Star pipe is formed from fine steel, then fully normalized . . . with multiple inspections assuring long, dependable service. Put your money on Lone Star. You can't lose . . . and you gain much!

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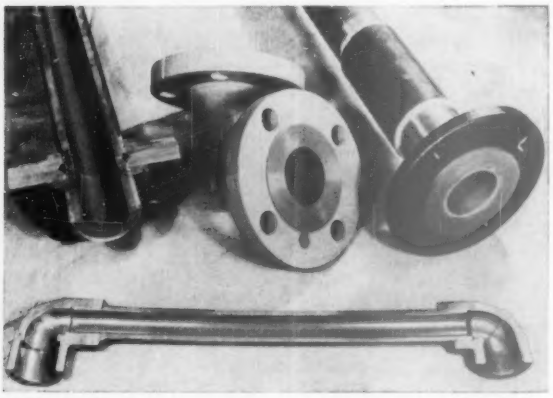
New Equipment

Rock drilling made dustless

. . . with a newly developed dust-collecting system now on the market for use with hand-held sinker drills. The DK 280 dust-collecting system can be used with any make of rock drills.

Dust and cuttings are trapped by a collar that fits around the drill steel and pulled through a connecting hose to a dust-collecting tank.

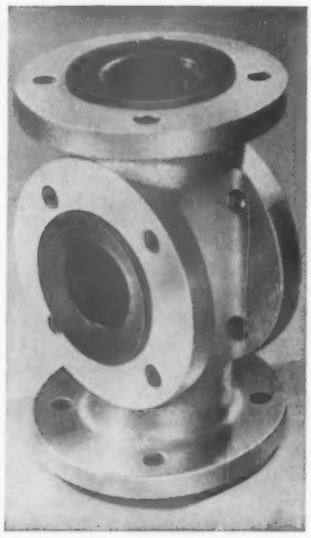
According to the maker, the system eliminates dust as a health hazard and increases air-tool operator comfort and efficiency. The dust-collecting tank can be mounted on any compressor-carrying truck, portable compressor, or combination tractor - compressor. Source: **Le Roi Div., Westinghouse Air Brake Co., Milwaukee 1.**



Plastic-lined pipe

. . . and fittings, and all-plastic fittings just disclosed are lined with a chlorinated polyether thermoplastic, Penton, that is said to be exceptionally corrosion-resistant and has the ability to handle elevated temperatures, including low-pressure steam.

The Penton-lined and all-Penton fittings and the lined pipe are expected to prove exceptionally useful in piping hot, corrosive fluids in processing and petrochemical manufacture. The maker says the piping will cost substantially less installed than metal, alloys, and other materials conventionally used for process piping above the temperature range of unplasticized PVC and up to about 280° F. Initial production is planned for all-plastic fittings in sizes from ½ to 2 in., Schedule 80. Lined fittings are planned in sizes from ½ to 3 in. These will conform to ASA Standard B16.1, Class 125 dimensions. Source: **Tube Turns Plastics, Inc., 2929 Magazine Street, Louisville, Ky.**



Cross unaffected

. . . by acids is now available. The Type S cross is lined with a nonporous compound made from tetrafluoroethylene resin. The liner extends over the full gasket face of the four flanges to provide a uniform, continuous barrier against corrosive fluids. A dynamically balanced rate of thermal expansion-contraction is maintained between the 150-lb. ductile-iron housing and the inner wall of the liner to overcome the effects of thermal shock and fatigue stress.

The cross is made in sizes of 1 to 6 in. with flange dimensions and bolt circles to ASA Standards. Delivery time: 4 weeks. Approximate price ranges from $75 to $400. Source: **Resistoflex Corp., Roseland, N. J.**

Electrode holder

. . . just announced is designed to do away with electrode-holder heating and so keep the operator's hand cool. To do this, the cable is brought directly to within a fraction of an inch of the electrode but does not pass through the holder handle, and an aluminum hand guard is used to protect the hand from radiated heat. It sells for about $15. Source: **Bernard Welding Equipment Co., 10228 South Avenue N, Chicago 17.**

Correction

The Model 450-HCM can-closing and embossing machine made by Continental Can Co. closes cans at the rate of 600 cans a minute instead of 60 cans a minute, as reported in the December 14, 1959, issue of The Oil and Gas Journal.

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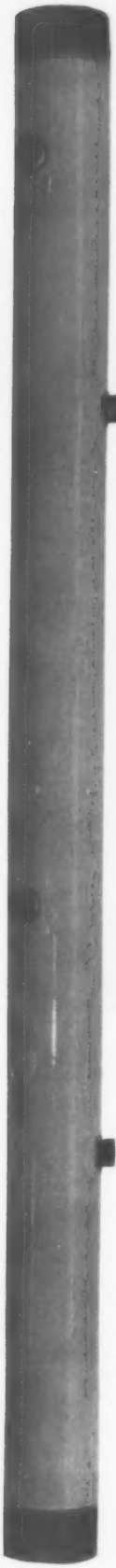

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- Shoot and test on same set-up
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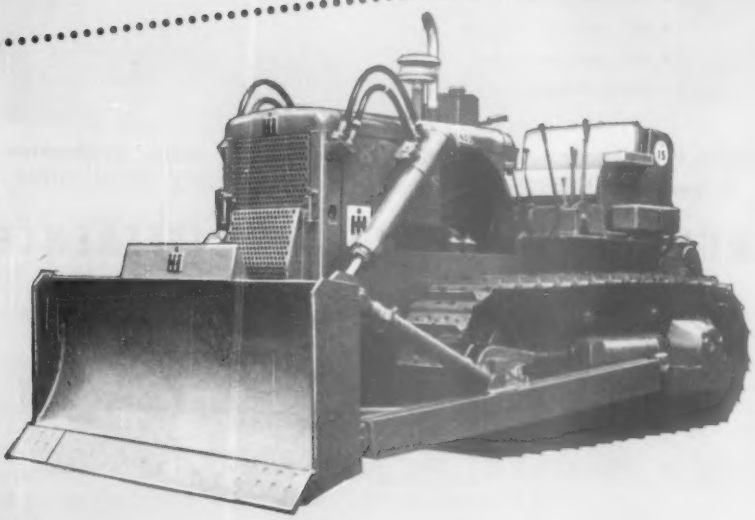
"My NEW TD-15 gives BIG TRACTOR work output... yet it's sized for easy transport!"

Oilfield Contractor George Baize, Hill City, Kansas

Oilfield Contractor George Baize works in a 3-state area in a 400-mile radius of Hill City. Easy equipment "haulability," without permit delay, is vital for him. View shows him using 2-way radio to contact the superintendent on one of his jobs.



New 62-inch gauge International TD-15 Oilfield Special crawler —shown equipped with new 8-foot outside push-arm hydraulic bulldozer. New earthrolling blade contour, diagonal reinforcing struts, and columbium-treated steel push-arms match this blade to TD-15 power, for record new pit-digging production! Operating weight of TD-15 and dozer: 26,000 live-action lbs.

Mr. Baize's new TD-15 is shown building up the retaining walls of a reservoir pit—at an oil tank battery near Hill City, Kansas. Shuttle-Bar control permits *instant reversing* to speed the shuttle-cycle!

"My new TD-15 is surely the fastest unit—dozing a gear faster than the other machines working alongside—and pushing the same loads," states Oilfield contractor George Baize. "The '15' is great for pit-digging and location work!

"My new TD-15 has big tractor work output, yet retains a smaller machine's size to make road-hauling easy."

You get 20,500 pounds push to outdoze "the others!" And the new International TD-15 Oilfield Special gives you a 6-speed, full-reverse transmission. You change gears and change forward-reverse directions with one fast hand sweep of the "single stick" shift and the Shuttle-Bar control lever. You 'doze out passes like clockwork, with finger-tip ease!

You get the smooth power of the millions-of-hours-proved International D-554 diesel—under the TD-15's hood. This 6-cylinder engine develops 105 high-torque hp!

You get 62-inch-gauge stability and maneuverability in the TD-15 Oilfield Special. Yet maximum overall width of only 8′ eliminates need for highway haulage permits in most states!

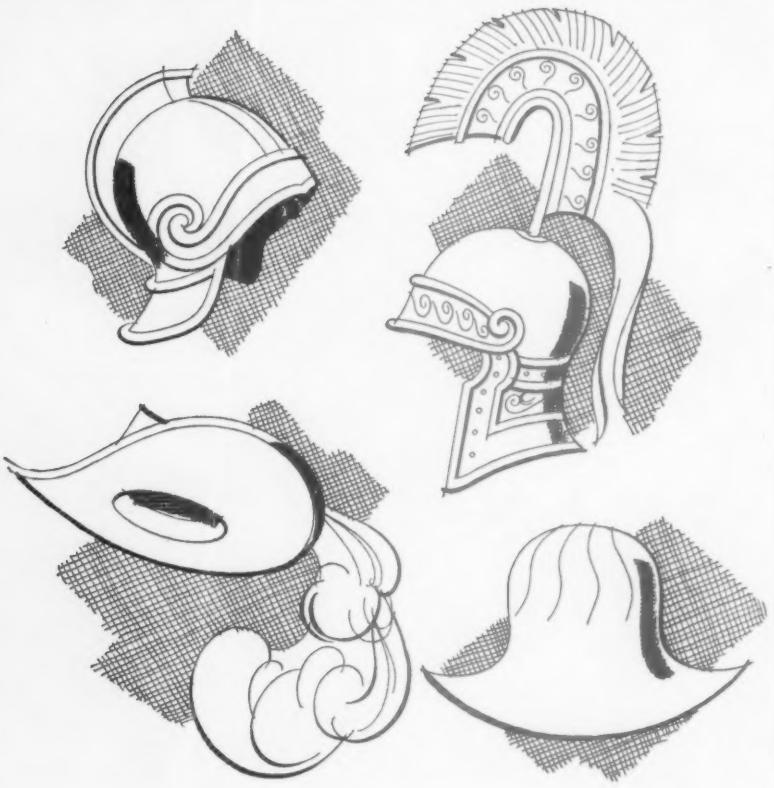
Prove it's the fastest producer—the most for your money—of its size class. Compare the new International TD-15, equipped with the new outside-push-arm hydraulic bulldozer, to anything else on tracks in the 100-hp class—for digging pits, clearing sites, doing all kinds of location jobs. Let your International Construction Equipment Distributor demonstrate!

International® Construction Equipment

International Harvester Co., 180 North Michigan Avenue

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers and Bottom-Dump Wagons . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

Which hat was worn in the 17th Century?



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ANSWER: The chapeau at the lower left — naturally, because the other three are helmets, not hats. At the top right is a Greek helmet, at the top left a Roman helmet, and at the lower right, a Sallet helmet from the 15th Century.

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PACING PROGRESS WITH CREATIVE CHEMISTRY

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CHLORINE • MURIATIC ACID • HYDROGEN • DRY ICE • GLYCOLS • SYNTHETIC DETERGENTS
SODIUM CMC • ETHYLENE OXIDE • ETHYLENE DICHLORIDE • POLYETHYLENE GLYCOL • PROPYLENE OXIDE
PROPYLENE DICHLORIDE • POLYPROPYLENE GLYCOL • DICHLORODIMETHYLHYDANTOIN • CHLORINATED SOLVENTS
OTHER ORGANIC AND INORGANIC CHEMICALS

SHOWCASE . . .

New Literature

Data-processing

. . . equipment in use including digital data processing and analog and digital computing systems, is discussed in Publication N-07(1). It explains types of inputs, input switching, output devices, and modes of operation for applications in electric power and petrochemical fields.

The 48-page publication is heavily illustrated with photographs and specifications of different installations. Source: **Leeds & Northrup Co., 4934 Stenton Avenue, Philadelphia 44.**

Free sample

. . . of spray-on lubricant for protecting wire rope and cable can be yours for the asking. Packaged in a 16-oz., push-button, aerosol container, the lubricant penetrates to the rope core, lessening internal friction and increasing rope life up to 300%, the maker asserts.

In addition, it eliminates rust and corrosion and its "nongumming" qualities reduce "carry-back" of abrasive dirt and dust. Source: **Whitmore Mfg. Co., P. O. Box 1640, Clevelond 14.**

Separaids

. . . bulletin discusses a family of products that aid in dewaxing and deoiling lube-oil solutions. The literature notes that the Separaids—Types C and F—have proved effective in dewaxing where centrifuge or filtration is used.

In addition, both can be applied in deoiling petrolatum and wax stocks, yielding a wax which is harder and which has a higher melting point. Complete application and test data on the two Separaid types are given. Source: **L. Sonneborn Sons, Inc., 300 Park Avenue South, New York 10.**

Valves and fittings

. . . for 30,000 and 60,000-psi. service as used in petroleum and chemical pilot-plant testing and in geophysics are dealt with in a new catalog. Included are 16 pages of full dimensional data, cross-sectional drawings, tubing sizes, and catalog designations for 32 conventional valves and fittings —couplings, adapters, tees, crosses, gage connectors, safety-head assemblies, and nipples.

Catalog 659 also provides informa-

tion on four types of thermocouple adapters and the new HIP relief valve, in addition to standard connections for ⅛, ¼, ⅜, and ⅝-in. o.d. tubing. Source: **High Pressure Equipment Co., Inc., 1222 Linden Avenue, Erie, Pa.**

Metal treatment

. . . stops rust action and prepares rusted metal for paint, as described in a new four-page folder. The literature tells why the treatment—identified as Ospho—provides a good bond between new metal and paint. It includes information on how to apply the treatment, its uses, and prices. Source: **Rusticide Products Co., 3125 Perkins Avenue, Cleveland 14.**

Buyers' guide

. . . with valve comparisons contains a cross index of valves offered by several manufacturers, along with a list of frequently used abbreviations, a valve trim chart, a list of valves conforming to federal specifications, and complete figure-number descriptions. The 24-page publication includes a breakdown of products by valve material and pressure class, type classification, disk design, seating arrangement, stem operation, bonnet, and end connection. Source: **Ohio Injector Co., Wadsworth, Ohio.**

Drainage

. . . and regulation controls are described in a new, obtainable publication, yours upon request. It details steam traps, pressure reducers, and pressure regulators. Complete and detailed information is offered, in tabbed and indexed form, on applications, capacities, sizing and selection, preventive maintenance, and trouble shooting. Source: **Clark Mfg. Co., Dept. C, 1830 East Thirty-eighth Street, Cleveland 14.**

Ultrasonic cleaning

. . . tips are given in new four-page Bulletin 16A now obtainable. It describes the process by which high-frequency sound waves impart intense scrubbing action to solutions to speed cleaning. The method's success, however, depends in large measure on the cleaning solution, according to the bulletin.

Included are compounds which have proved effective, and the types of operation ultrasonic cleaning does best. Source: **Oakite Products, Inc., 159 Rector Street, New York 6.**

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VIKING LIQUID ABRASIVE PUMPS

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Now, you can double or triple pump life with this new heavy-duty Viking. Specially designed with ceramic bearings and mechanical seals to pump paints, inks and other *abrasive liquids. Field tested and proved, pumping liquids from 100 S.S.U. to the heaviest viscous types . . . G.P.M. sizes 3, 6, 12, 16, 25, 40. Let us help you solve your problem.

* Consult factory for recommendations on pumping abrasive liquids other than paints or inks.

PLEASE SEND US THIS INFORMATION:

- Liquid to be pumped
- Viscosity of liquid (S.S.U.)
- Percentage and type of solids present in liquid
- Temperature of liquid
- Specific gravity
- Capacity of pump needed
- Suction lift or head
- Discharge pressure

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WRITE FOR NEW VALVE BULLETIN
P. O. Box 1739, Tulsa

VALVES

▶▶▶ Equipment Men Notes

Ed B. Lockey to represent

E. B. Lockey

. . . Orbit Valve Co. in North Louisiana, Mississippi, and South Arkansas, under the direction of James P. (Jim) Bowling, division sales manager. Appointment of the new sales representative was announced by L. E. Wallace, general sales manager of the Tulsa manufacturer.

Prior to joining Orbit Valve, Lockey was a service engineer for 6 years with an oil-tool manufacturer. Before that he served for 8 years as assistant engineer and purchasing agent for a Louisiana gas company. Lockey now will locate in Bossier City, La.

Fluid Brake Co. is organized

. . . in Houston for the exclusive manufacture of fluid-type auxiliary brakes. Joe A. Lyne is president. Built for rotary draw works and other types of heavy hoisting equipment, production is under way with some units already in the field.

Two sizes of the brakes are being manufactured by the firm. According to Lyne, one size is normally used for drilling depths to about 15,000 ft., and the other for deepest drilling on the heaviest rigs.

H. R. Safford, Jr. is elected

H. R. Safford, Jr.

. . . executive vice president of the Petroleum Equipment Suppliers Association, reports Wallace D. Wilson, president. Safford, who maintains headquarters in Houston, has been PESA's executive secretary since 1946. The association is made up of those companies engaged in manufacturing and supplying equipment and services for the petroleum industry.

Fred Stephens takes ownership

. . . of the firm Cable & Stephens, Petroleum Engineers, Wichita Falls, Tex., having purchased the partnership interest of Jo H. Cable. The firm name is now Stephens Engineering.

Cable established the concern in 1928. He will be associated with Stephens Engineering as a consulting engineer. The firm specializes in petroleum-evaluation reports, reservoir studies, installation and supervision of gas and water-injection projects, core analysis, and bottom-hole-pressure surveys in Texas, Oklahoma, and New Mexico.

Welex, Inc. promotes two

. . . veteran employes to vice president. Affected are Oklahoma Division Manager Larry Drake and B. A. Redwine, Gulf Coast sales manager.

Drake was promoted to vice president in charge of the Oklahoma division. He will remain in Tulsa. Redwine takes over as vice president in charge of Texas and Louisiana Gulf Coast sales and operations at Houston.

Larry Drake

B. A. Redwine

Meanwhile, Vice President G. T. Armstrong was transferred from Houston to Welex's Fort Worth headquarters in charge of sales and operations. Chief Engineer W. D. Smith was sent to Houston from Fort Worth as director of engineering at Welex's Research and Engineering Center. H. K. McArthur was shifted from Houston to the Fort Worth operations department under H. B. Lee, operations vice president.

DIAMOND DRILLING BIT of Drilling & Service, Inc., is being examined by William McCormack, right, sales manager of D&S; and Don L. Paxter, president of the advertising agency which serves the company. The new TRY-Y bits have set drilling records in some of the most difficult formations in the United States.

Dresser Industries, Inc. plans

. . . to construct the world's first petroleum-industry supermarket in the Midland-Odessa, Tex. area. The announcement came in Odessa following a day-long meeting of officials of Dresser and its subsidiaries which operate in the Permian Basin.

Location of the Dresser Service Center has not been determined but it will include an office building to provide quarters for the various subsidiaries, warehouse and other storage accommodations, and servicing facilities. Plans for the center were outlined by John B. O'Connor, president of the parent company, and H. N. Mallon, board chairman.

O'Connor said it will be the first installation of its kind in the world and, when in operation, will coordinate the personnel of all Dresser units in the Permian Basin.

Mountain Iron & Supply makes

. . . several executive promotions. R. F. (Bob) Miller has been named vice president for sales, Kansas-Panhandle district, with offices in Wichita. Appointed to serve under Miller as Kansas district sales manager is Ralph Hamilton.

R. F. Miller

W. E. Frevert

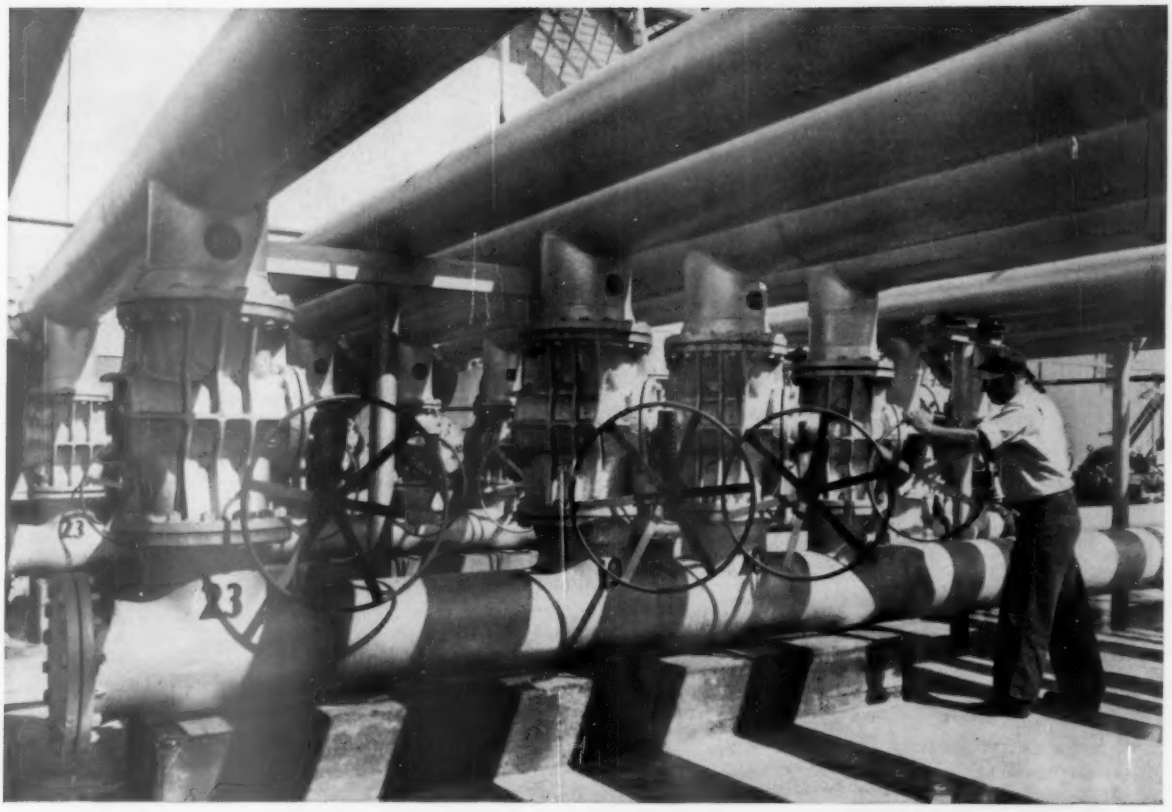
W. E. Frevert has been promoted from Rocky Mountain area manager to vice president of the district, headquartered at Denver. Jerry Bouse has been appointed district sales manager at Mountain Iron's new retail outlet at Calgary, Alta.

John S. Talbot to head

. . . the service section of Dow Industrial Service, the company's newest division. Talbot had been manager of Dowell's district office at Houston since 1950.

Dow Industrial Service, headquartered in Cleveland, has district offices in Los Angeles and Birmingham. It began operations last month and will take over solvent-cleaning functions formerly performed by Dowell Division of The Dow Chemical Co.

Talbot has been in the industrial-service field since joining Dowell in

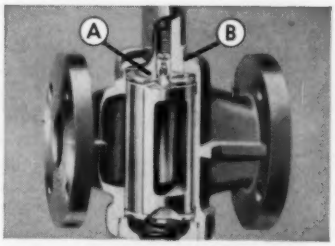


When it comes to quick, efficient control of petroleum products . . .

these Homestead® Lubricated Plug Valves handle 2,000,000 barrels a month!

At the West Coast marine terminal shown above, the tremendous flow of gasolines and oils from storage and tankers demands smooth, positive operation at all times. For this reason, 33 Homestead Lubricated Plug Valves in sizes from 8″ to 16″ were specified for this installation.

Today more and more oil companies specify Homestead Valves for their dependable, maintenance-free performance and built-in engineering advances. For example, *100% pipe area* reduces ship loading and unloading time. *Pressurized chemical seal* and closely fitted plug and body assure positive shut-off, no mixing of different fluids. *Controlled lubrication* provides full coverage of sealing surfaces without contamination of line fluids. *Quick operation* . . . Homestead Valves are fully opened or closed in a quarter turn of the plug.



Cross-section of Homestead Lubricated Plug Valve. Triple head seal (A) prevents leakage. Tell-tale lubricant ring at (B) signals full system, prevents waste of lubricant and contamination of line fluids.

For complete details and valve recommendations for *your* application, mail coupon below.

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Coraopolis, Pennsylvania

Homestead Valve Manufacturing Co.
P.O. Box 406, Coraopolis, Pa.

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Please send reference books on Homestead Lubricated Plug Valves and their uses.

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Company.....

Address.....

City..... Zone..... State.....

the Cleveland district office in 1946. He was assigned to the Houston district in 1947 and served as sales and development engineer and district engineer before his appointment to district manager at Houston.

Halliburton opens sales offices

... in Dallas and Houston, according to Ed Trapp, sales manager.

Heading the Houston office is Schley Babin, transferred from Tulsa. He has been employed by Halliburton Oil Well Cementing Co. as operator, tester, and engineer since 1949. Bill

Schley Babin

Bill Taylor

Taylor opens the Dallas office after completing an assignment at Farmington, N. M., as district engineer. He was first employed by the company in 1946.

Ken Manes

Pat Broussard

Replacing Babin at Tulsa is Ken Manes, former Halliburton district engineer at Seminole, Okla. He joined the firm over 11 years ago and has been a cementer, tester, special-tools operator, and engineer in the Pacific and Mid-Continent areas. Meanwhile Pat Broussard was promoted from assistant division engineer to division engineer at Houston. Since 1948 he has held varied operating and engineering assignments for Halliburton along the Texas and Louisiana Gulf Coast.

Tuboscope Co. acquires

... all of the outstanding stock of Tube-Kote, Inc., making it a 100% Tuboscope subsidiary. The company's prior ownership was about 60% of Tube-Kote.

Tube-Kote, headquartered at Houston, supplies plastic coatings for oilfield tubular goods and furnishes coatings and coating services for other industrial uses.

NEWLY COMPLETED FACILITIES of Tretolite Co. at Great Bend, Kans. include offices, a stock warehouse, and a modern-equipped technical laboratory. Donald Garland, former laboratory technician at the company's main plant and research lab in St. Louis, will be in charge of the new laboratory. Tretolite is a division of Petrolite Corp.

Hutchison Mfg. Co. is acquired

... by Revere Electric Mfg. Co., of Chicago, announces J. E. Smith, Hutchison president. Smith said Hutchison will continue to operate under its present name but as a wholly owned subsidiary of Revere Electric. Plant and office will remain in Houston.

Hutchison manufactures the Rumba shale shaker for drilling rigs, the Flolight vaportight derrick lighting systems, floodlights, control panels, and electrical-distribution systems for crew camps in remote areas.

Tubular Lining Corp. appoints

... DeWayne Higdon as South Texas regional sales manager. Tubular Lining is a manufacturer and applicator of baked-on corrosion and paraffin-resistant linings for oil-field tubular goods.

A. H. Simpson is appointed

A. H. Simpson

... commercial manager of Woodfield Rochester, Ltd., in which post he will assist R. H. Corbett with company sales responsibilities. Simpson was formerly general sales manager of Shaw-Petrie, Ltd., and Clyde Tube Forgings, Ltd.

William W. Cathriner joins

... the sales staff of Dunwoody Pipe & Supply Co. where he will concentrate his sales efforts in the Houston and Oklahoma areas for the Houston-based firm. Cathriner was formerly a senior sales representative in the Houston area for Hydril Co. He had been with Hydril for 7 years.

Ted C. Graham becomes

... division sales manager for Bethlehem Steel Co.'s Supply Division at Calgary, Alta., reports J. V. Spalding, general sales manager. Graham, a 20-year veteran in manufacturing, service, and sales with Bethlehem, joined the company as a field representative at Kilgore, Tex., in 1920.

VESSEL IS RAISED to its elevated foundation in a new petroleum coke unit of Suntide Refining Co. Suntide's unit was under contract to Refinery Engineering Co., Tulsa, as general contractor. A. O. Smith Corp., Milwaukee, got the contract to fabricate and erect the two drums. Since the completed vessels (17 ft., 6 in.) could be shipped whole by water from Houston to Corpus Christi, A. O. Smith gave the contract for assembly and erection to Wyatt Metal & Boiler Works, Inc., which permitted completion of the vessels under the advantages of shop facilities. Berry Engineering & Construction Corp., Corpus Christi, had the contract for hauling and erection under Wyatt's supervision.

"NO REPAIRS on Wichita Clutches"

SAYS

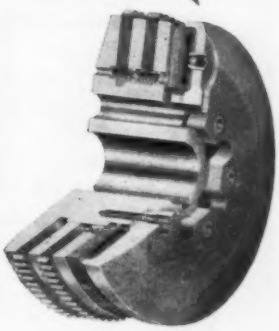
H. R. KRAMP
Vice President and
Asst. General Manager
FRED E. COOPER, INC.
Tulsa, Oklahoma

Cooper Skytop Model T4210-38 Self Propelled Oil Well Servicing and Workover Rig equipped with Wichita Air Tube Clutches . . . the entire rig is engineered and built by Cooper to do the most rugged oil field jobs with dependability and efficiency.

"The first Cooper machine with Wichita Air Clutch was built in 1953," says H. R. Kramp. "Our records show no clutch repair parts sold for this machine, even though it has been in heavy service."

"Our customers like Wichita Clutches because they have smooth action, are dependable, and require no special attention or adjustment even when handling maximum loads."

Such a testimonial is typical of the enthusiastic approval of many users of Wichita Air Clutches and Brakes in a wide variety of industrial applications. For prompt assistance in solving your clutch or brake problems call or write the nearest Wichita Clutch office.



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Ventilated Air-Tube
Disc Clutch

WICHITA Clutch COMPANY, INC.
WICHITA FALLS, TEXAS, U.S.A.

Contact your nearest Wichita Engineer!

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Frank W. Yarline Co., Chicago, Illinois
Larry W. McDowell, Long Beach, California
Andrew T. Lobel, Denver, Colorado
Robert R. King Co., Cleveland, Ohio
Norman Williams, Houston, Texas
Allied Transmission Equipment Co., Kansas City 8, Missouri
Donald E. Harman, Dallas, Texas
C. Arthur Weaver, Richmond, Virginia
Malcolm S. Cone, Memphis, Tennessee
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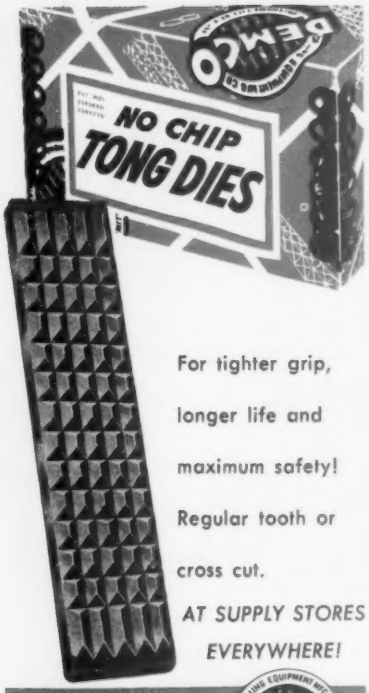
Bates Sales Co., St. Louis 1, Mo.



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POSITIVE EXPANDING ANCHOR

BUILT ESPECIALLY FOR OIL FIELD USE

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BOX 111 • WINTERSET, IOWA

AUSTRALIAN ROUGHNECK is shown with native helper on American rig in Timor.

Natives help drill Triassic test on Portuguese Timor

NORTH OF AFRICA in Portuguese Timor, Sunset International Petroleum Corp., Beverly Hills, Calif., and Tradewinds Exploration, Inc., Denver, are using some native help on their second Triassic test being drilled.

The second well is located about 1½ miles northwest of the first test which was suspended recently after an unsuccessful fish job at 6,700 ft. The first well was believed to be on the downside of a fault.

The structure being tested is a 5½ by 3-mile anticline on the south coastal plain at the eastern end of the island. The two companies share a one-half interest in a 7,000-sq.-mile concession. The other half is held by Timor Oil, Ltd., an Australian firm.

Drilling contractor on the job is Roden & McRae, the drilling division of Tradewinds. An 8,000-ft. Brewster N-55 rig is being used to drill the wildcats.

On Sumatra trend . . . The structures slated for testing in Timor are on the trend with major oil fields at Sumatra and Java. The name of the structure currently being drilled is Ossulari. The next anticline, the Viqueque, located about 7 miles northwest of the present activity, is slated to get the third wildcat. A third structure on the west end of the concession is also slated for drilling.

Not far from the Ossulari and Viqueque structures, natives have been bailing oil seeps for years at Aliambata. One group of seeps has been good for 7,000 bbl. yearly. On the west end of the Portuguese portion of the island, two seeps produce around 3 bbl. daily of 33°-gravity crude. These westside seeps are from Miocene and Tertiary-Eocene rocks while those at Aliambata are from the Triassic.

A wildcat drilled to 1,800 ft. in 1926 still produces a small amount of heavily cut oil from the abandoned surface casing which sticks up about 3 ft. above the ground.

Tulsans purchase drilling company

A TULSA GROUP represented by John S. Carlson, attorney, has purchased Hilton Drilling Co., Inc., Great Bend, Kans. and will consolidate its acquisition into a new company—Western Petroleum Co., headed by John T. Ross, Great Bend, president.

The effective date of operation of the new firm was January 1, with Carlson as secretary-treasurer. The deal was closed for approximately $1,000,000 cash plus oil payment.

The sale included two rotary rigs, an office building, all vehicles, and approximately 200 bbl. of daily oil production from 70 wells on 2,280

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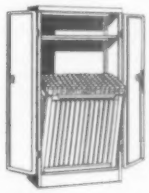
MAP  FILE

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The sturdy MT4 steel cabinet map file has 112 tilting tubes. Easy to file and find maps, tracings and blue prints to 60" lengths. Keeps valuable information dust proof and confidential. Popular everywhere in both field and home offices. Write for illustrated information.
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EVALUATION CORE ANALYSIS
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acres. Some of the acreage involved remains to be developed.

E. M. Hilton, Jr., who has been president of the acquired organization, has not disclosed his future business plans. Dan Cook, formerly vice-president of Hilton Drilling bought the cable tools Hilton operated and will establish himself as an independent.

All of the Hilton operating personnel, excepting Hilton and Cook, will be retained for a proposed extensive exploration and development that is forthcoming, according to Ross.

Hilton interests were represented by Oliver Hughes, Wichita attorney, and Western interests were handled by Carlson.

Signal moves to Denver location

THE HEADQUARTERS of Signal Drilling & Exploration, Inc., Signal Oilfield Service, Inc., and Pennant Drilling, Ltd., has been centered in Denver since January 1.

C. E. Wright, vice president and treasurer of the affiliated companies, closed down the Tulsa offices last week, providing consolidation of the Tulsa and Denver offices. President F. M. Stevenson has directed the Denver offices for some time at 415 Petroleum Club Bldg.

Wright explained the move to Denver was dictated by the scope of the firms' business which now is centered in the Rocky Mountain region and Canada.

The companies offer cable and rotary drilling, slim-hole drilling, and mobile well services.

Wright and Stevenson first formed a partnership in January 1946, as Signal Oilfield Service to engage in well-completion work in Kansas. In November 1948, they organized Signal Drilling, Inc., as a corporation to offer rotary work in the Rocky Mountain area. About 3 years later Signal Exploration, Inc., was formed to engage in rotary work in North Central Texas and later was merged with Signal Drilling to form present company. In 1952, Pennant Drilling, Ltd., was organized to work in Canada.

The combined companies operate 13 rotary rigs ranging from 13,500-ft. depth to 2,500 ft. primarily in the Rockies and Canada. Other equipment includes three reverse circulating units, two mobile service rigs, and 10 cable-tool units. Total value is about $5 million.

Branch offices are maintained at Shidler, Okla.; Great Bend, Kans., Farmington, N. M.; Glendive, Mont.; Casper, Wyo., and Calgary, Alta.

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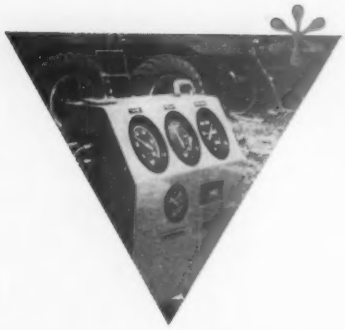

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...the new Halliburton Recording Service that uses the FRACOMETER/DENSOMETER INSTRUMENT TEAM to help improve Production Stimulation Treatment Control with VISUAL and PERMANENT records *instantly.*

HERE'S HOW IT WORKS!

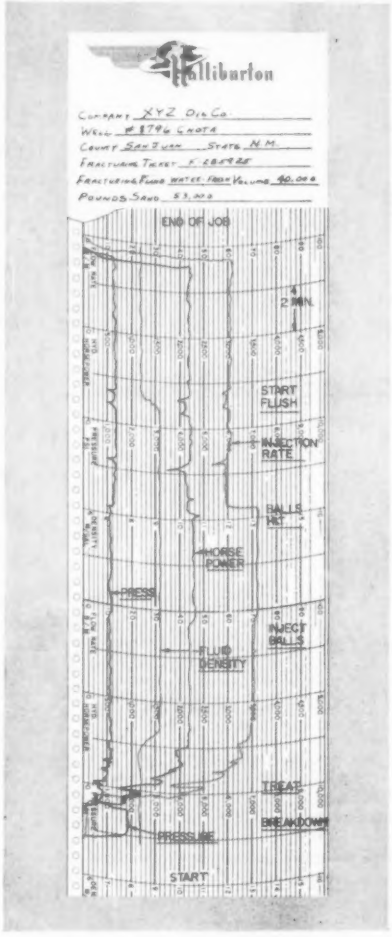
Halliburton's new *FRACOMETER* is a pneumatic instrument providing remote indication and recording of flow rate, wellhead pressure and hydraulic horsepower during fracturing. The DENSOMETER reports ratio of sand to fluid in terms of total fluid density.

HERE'S WHAT IT DOES!

With this instrument team, you can constantly follow the fracturing operation involving flow rate, pressure, horsepower, fluid-to-sand ratio and total gallonage. With this record at your fingertips, you can determine needed treatment modifications immediately.

HERE ARE SOME RESULTS!

Many major companies as well as independents have made exhaustive field tests to determine the value of the Fracometer/Densometer Instrument Team. Over 100 successful job performances have led customer after customer to express their complete satisfaction with its operation and accuracy. On your next fracturing job, specify Halliburton's advanced AUTO-FRAC* and *see* the results yourself *as they are being made.*



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"STILL THE PIONEER IN FORMATION FRACTURING TECHNIQUES"

THE outstanding events in oil exploration during the 1950's are pinpointed on this map. It was a decade of achievement, more rewarding and exciting than either the forties or the thirties, as far as expanding horizons of oil were concerned. Five new producing states, half a dozen new basins, and many new concepts of the occurrence of oil . . . all contributed to a most successful 10 years.

Can we do it again?

BY FRANK J. GARDNER

THEY SAY one should never look back. It's supposed to be better to live for the future and forget what is past. But a little hindsight now and then can make the future look much less formidable, especially in the business of finding oil.

So as we enter this new decade, perhaps a glance over the shoulder is in order. Were the fifties really as bad as the gloomsters would have us believe? Have we truly reached the point of no return in oil finding?

Take a good look at the map on this page. Any memories there? Ten years ago today, there was no Williston basin folder in your files. There was no Denver basin, no Paradox basin, and probably no Anadarko basin. Alaska was just a place up north. And Spraberry was something, you thought, that grew on a bush.

The deepest hole in the world was 20,521 ft. as 1950 dawned . . . "the industry's long-sought goal," the Journal said. Nobody dreamed that 8 years later, that goal was to be bested by 4,819 more feet.

United States crude reserves stood at 26 billion barrels on January 1, 1950. Since then, we've produced 23 of that 26 billion, and we have 33½ billion in the bank. Daily production at that time was 5,043,000 bbl. Today, it's 7,043,000 . . . a hefty gain of 40%.

Any room for gloom in that record? Any sound reason to believe that the pattern won't be repeated in the sixties? History says no. Remember, we were "running out of oil" 30 years ago!

As for running out of places to drill: in the past 10 years, drillers have invaded for the first time some of the largest sedimentary basins in the country. They were totally unproductive prior to 1949. Today, they hold some of the largest proved oil reserves on record. And they're far from adequately explored. There's plenty of room to play in Williston, Paradox, Black Warrior, and Anadarko. The plains of western Kansas and Nebraska are not exactly congested. The continental shelves lie practically untouched. And if you're really hard up for a drill site, there's always Alaska—tempting as Texas and twice as big.

The fifties welcomed many new states to the producing column: Arizona, Nevada, North Dakota, South Dakota, and Washington. Alaska had some production in the early 1900's, and the Naval Petroleum Reserve was an unknown quantity; but the discovery at Kenai in 1957 established the state as a prime prospect for years to come.

So it was that the oil man's vocabulary expanded in the decade just closed. He learned new names, visited new places, heard new expressions. A "fractured" well in 1949 would have meant little to him. "Las Animas" was Spanish for "the spirits." And Paradox was just a word.

What new names will we hear in the sixties? There may be many. Black Mesa, Palo Duro, Raton, Disturbed Belt, Lucero, Arkoma, to name a few. New states? Don't be surprised at Georgia, Iowa, South Carolina, Oregon, or Idaho.

If this page sounds overoptimistic to you, remember that optimism is the key to discovery. Without it, there'd be little hope that the pattern of the fifties might be repeated in the sixties. As the Rocky Mountain Geological Association's Newsletter put it recently: "Let's be nonconforming optimists, for certainly a conforming pessimist isn't going to find much oil."

Oil men in Oklahoma found this formation → had more oil-producing zones than any other when they took

TABLE 1—PENNSYLVANIAN STRATIGRAPHY (THIRD SEDIMENTARY UNIT OF MARIETTA SYNCLINE) OF SOUTHERN OKLAHOMA

Series	Group	Formation	Member
		Pontotoc group	Cherty conglomerate
Virgilian	Cisco		Cherty conglomerate
			Zuckerman limestone
			Daube limestone
Missourian	Hoxbar	Hoxbar	Anadarche limestone
			Crinerville limestone
			Confederate limestone
			Natsy limestone
			Williams limestone
	Deese	Deese	
			Rocky Point
Des Moinesian			Arnold limestone
			Devil's Kitchen
		Big Branch	Pumpkin Creek
			Frensley limestone
Atokan	Dornick Hills	Lake Murray	Lester limestone
			Bostwick conglomerate
			Otterville limestone
Morrowan		Golf Course	Joliff limestone
			Primrose sandstone
			Lake Ardmore sandstone
			Overbrook sandstone
			Rod Club sandstone
Springeran	Springer		
		Goddard?	

A closer look at Love County

BY C. C. REEVES, JR.
Texas Technological College,
Lubbock, Tex.

LOVE COUNTY was considered, not too many years ago, one of the poorest areas of southern Oklahoma with little chance for improvement. With the eruptive discovery of Southwest Enville, Love County and most of southern Oklahoma, underwent critical reevaluation.

Love County was surrounded by early development, but remained a virtual barren island till late in the thirties.

Oil was discovered in southern Oklahoma in the early 1900's. Such fields as Granite, Gotebo, Graham, Lawton, and Cruce were all producing before 1910, and in the next decade Loco, Healdton, Fox, Wildcat Jim, Milroy, Walters, Velma, Comanche, Hewitt, and West Duncan were found.

In 1922, oil was discovered near the county line in Carter County, 20-5s-1e. The Brock (Crinerville) field strike should have been closely followed by additional oil finds to the southeast in Love County but poor followup and poor geology delegated these to a later era.

In 1924, several structures just west of the Love County line in 6 and 7s-5 and 6w, Jefferson County, produced and in 1942 additional oil was found north of the Love County line along the Overbrook anticline.

Love County discovery wells . . . The first commercial production in Love County came in 1936 with oil at Stockton field, 6s-2w, by Sinclair-Prairie Oil Co. (Fig. 1). Almost simultaneously, an Amerada Petroleum Corp.-Stanolind Oil & Gas Co.-Westheimer-Daube Oil Co. test in 27-6s-2e found Ordovician - Viola production but proved noncommercial.

Sivell's Bend field, most of which lies across Red River in Texas, was discovered in May 1947 by Jake L. Hamon A-1 Kunkle, 12-8s-1w.

August 1949 saw the discovery of Northeast Greenville, an area which was destined to become one of the larger producers of the county. The discovery well, Sohio Petroleum Co. 1 Tims, 32-6s-2e, brought in Pennsylvanian-lower Deese production but additional drilling found it to be of local extent.

Pike North field in 5-7s-1w was discovered by Sinclair-Travis 1 Sanders in November 1951. During the same month Northeast Oswalt field,

This is the first half of a two-part report on Love County, long considered Oklahoma's "bare spot" in oil production. The second part, dealing with individual oil fields and future prospects, will appear in next week's Journal.

After more than 15,000 hours of steady operation **engine still runs like new!**

Report from drilling superintendent, W. F. Hicks

UV-549 V-8 engine 257 max. hp @ 3,400 rpm gasoline, LP gas or natural gas.

"Since December, 1957 this International V-8 has run almost continuously, 24 hours a day, supplying the smoothest, most efficient power a driller ever had. When we had a chance to take the head and pan off after more than 11,000 hours operation, we couldn't find any wear that could be measured, felt, or seen. Since then we have drilled another 75,000 feet of hole, and added 4,454 hours of operating time on this engine. And it still runs like new!"

A three-man crew handles this specially built rig for Davis & Davis, Inc., Coleman, Texas. The pipe is racked horizontally on a platform instead of in a vertical stack, and this eliminates the tower man from the four-man crew normally used on this size operation. It takes them about five days, working three shifts around the clock, to put down an average well of 2,300 feet. The International UV-549 powers draw works, rotary table and cat head.

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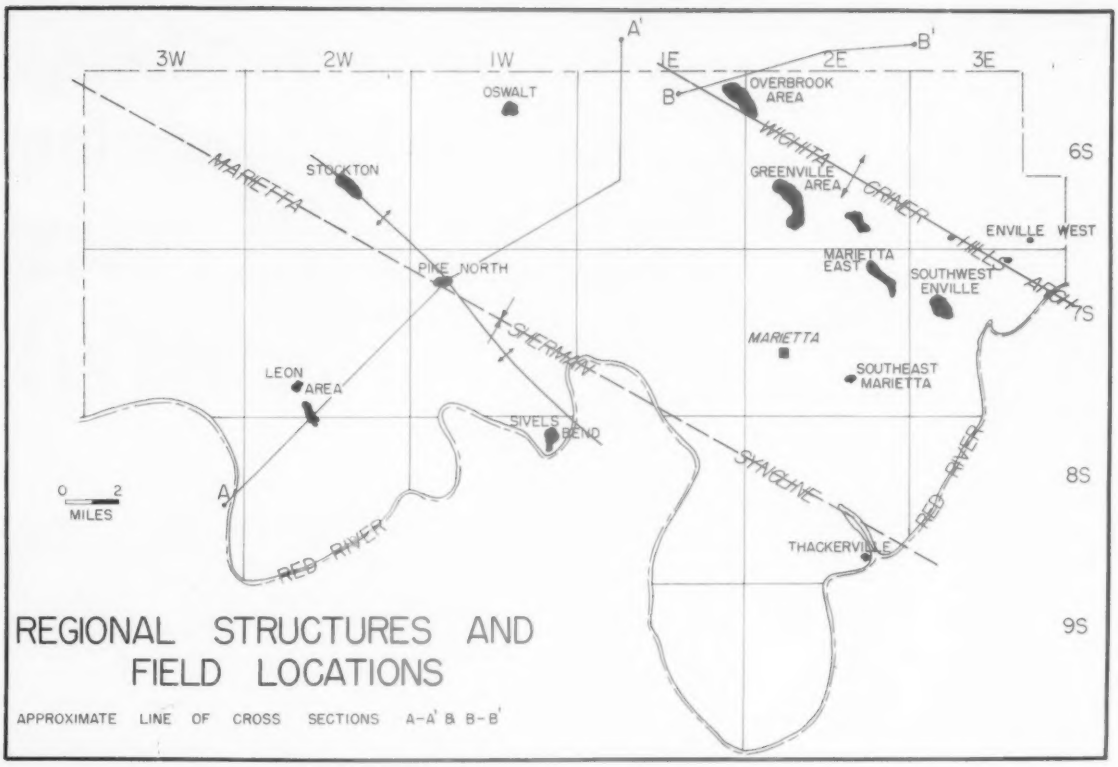
LOVE COUNTY



TWO DOMINANT STRUCTURAL FEATURES seen in Love County are the Criner Hills trend and the Marietta syncline. Relationship of producing areas to structure indicates no set pattern in the basin. Fig. 1.

10-6s-1w, was found by the Continental Oil Co. 1 Moxley.

In January 1952, the Sinclair 1 Taylor, 33-7s-2w, brought in Northeast Leon pool. Finally, in July 1954, attempts to enlarge the productive area of Northeast Greenville were successful with Pennsylvanian - Dornick Hills production in the Britton 1 Vestal, 28-6s-2e. Today three fields occupy the Greenville area which is perhaps the leading producer of the county.

Overbrook area strikes took place during the period of 1943-1956. Production, which often exceeds 240 bbl. per day per well, is from Pennsylvanian - Springer and Deese at a depth of only 1,130-40 ft.

One of the most interesting successful wells of Love County and the one largely responsible for the present drilling activity all along the Wichita-Criner Hills trend occurred in the spring of 1957 when Texaco Inc. 1 Westheimer, 17-7s-3e, blew in. Since the Westheimer was searching for a sand strand line it was quite surprising to most southern Oklahoma geologists when it uncovered a major producing structure, which already had two dry holes on it.

Other small fields with one or two wells exist in the county (Fig. 1).

Structure

Love County with two regional structural features transgresses the scale of complexity of any sedimentary column, bar none. The Marietta syncline has exhibited a general lack of major secondary structures but the Criner Hills epitomize what has been too often and too simply termed the "complex structure of southern Oklahoma."

Criner Hills . . . The Criner Hills, which is more completely termed the Wichita-Criner Hills trend, is an area of Paleozoic outcrops, most of which lie to the north in Carter County.

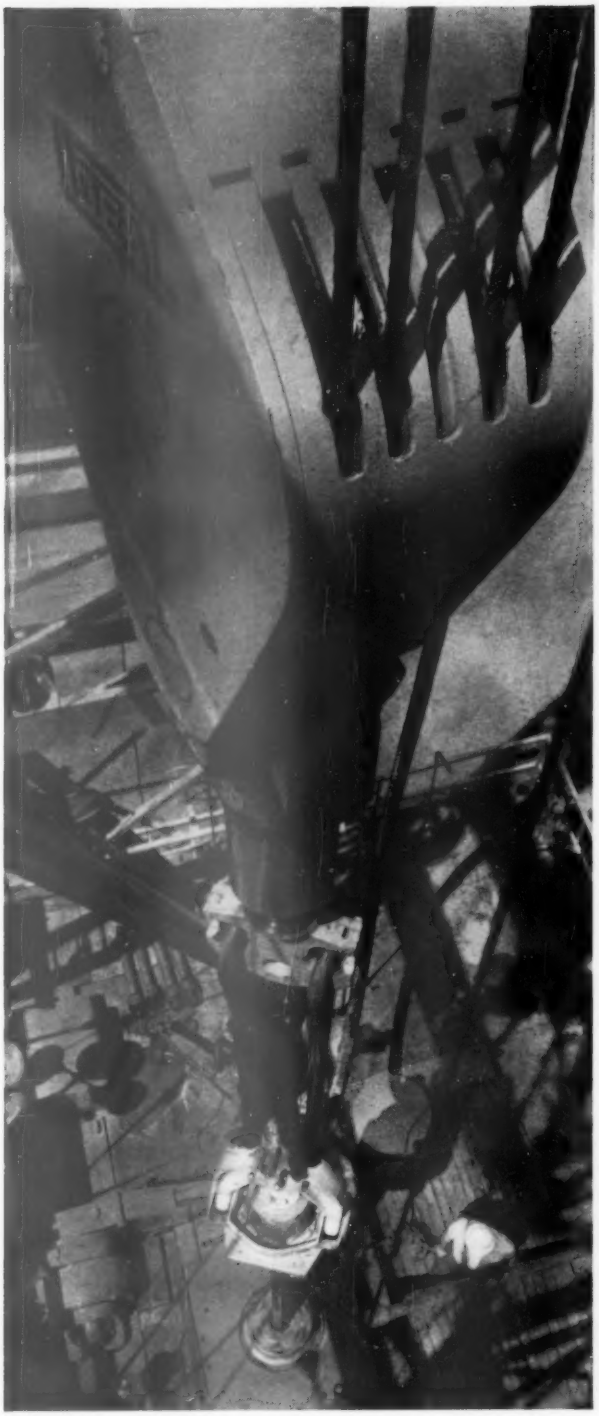
The Criner complex is essentially composed of three northwest-trending anticlines, the Criner, Rock Crossing, and Overbrook, each separated from the other by northwest-trending faults (Fig. 2).

The Criner and Rock Crossing anticlines show some relationship and are considered original entities of the Criner horst block which formed during early Pennsylvanian time (Wichita orogeny). The Overbrook anticline apparently formed much later, probably in late Pennsylvanian time (Arbuckle orogeny), and was thrust southwestward over the original Criner block by the northeast-originating stresses.

Peculiar structures . . . Several peculiar structural features are found in the Criner Hills. The Rock Crossing anticline, when traced to the northwest, divides, one branch plunging off to be buried by strata which form the Pleasant Hill syncline, the other branch continuing as a surface expression of the main structure. A syncline now lies over an anticline, and the surface outcrops vividly display the conflicting plunges of the separate structures.

The Criner fault presents an interesting problem near the Love County line. At Brock (Crinerville) field in Carter County, the fault was found to be normal with 70°-85° of dip. After the Cherry 1 Bourland, 1-6s-1e, was spudded up the upthrown side in Ordovician-lower Simpson it quickly passed into Pennsylvanian-Deese upon crossing to the downthrown block. Tomlinson reported this peculiarity as a "compressional normal fault, locally reversed."

Although the Criner Hills region



How National Supply gets more stability, cuts maintenance in Universal hook blocks

With as much as 300 tons swinging and swaying on this National Universal Hook Block, its sheaves must take terrific stress. To keep the block stable, working with minimum maintenance, National Supply Co. mounts the sheaves on Timken® double row tapered roller bearings. (Diagram below shows typical mounting of Timken TNASWE bearings). Timken bearings do the job because they . . .

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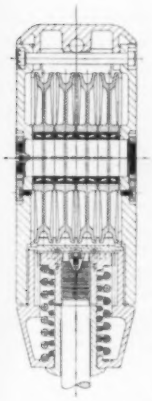

When you buy Timken bearings you get . . . 1) Quality you can take for granted. 2) Service you can't get anywhere else. 3) The best-known name in bearings. 4) The pace setter in lower bearing costs. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable: "TIMROSCO". *Makers of Tapered Roller Bearings, Fine Alloy Steels and Removable Rock Bits.*

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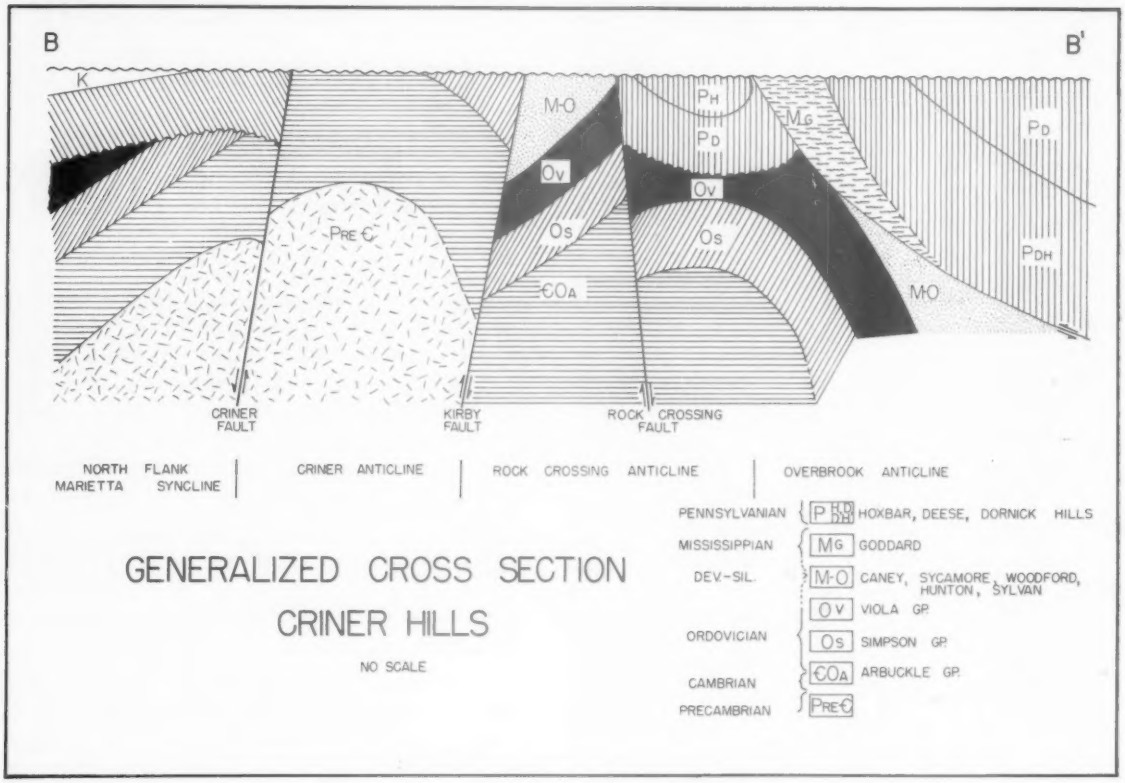
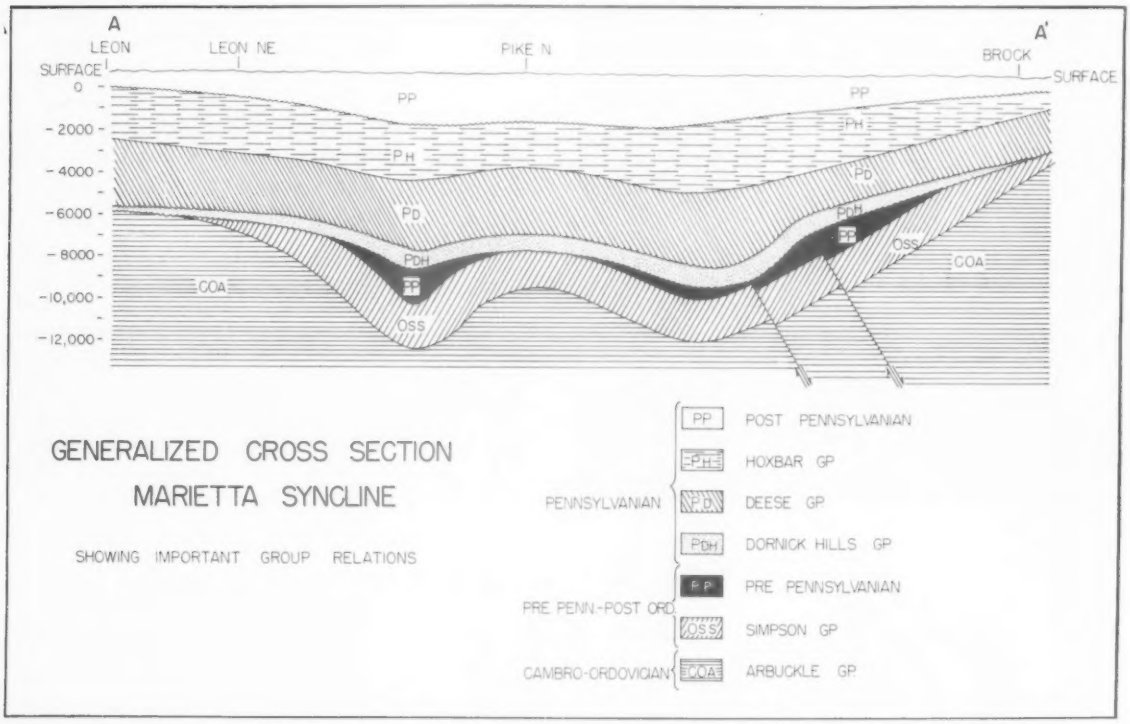
LOVE COUNTY



CROSS-SECTION presents some of the complexities of the Criner Hills arch. A good imagination is essential to unscramble the puzzles that well data provide. Fig. 2.



MARIETTA SYNCLINE generalized section indicates some of the challenges offered to geological interpreters. At least three unconformities exist. Fig. 3.

LOVE COUNTY

proper is the only area of Paleozoic outcrops in Love County, the trend most certainly continues to the southeast. It is doubtful that the three anticlinal trends found in the Criner Hills continue as such for any great distance. An apparently uncanny three-way structural relation correlation exists between the Criner Hills, Southwest Enville, and the Grayson County, Texas, area.

All three areas have long, northwest trending, overturned anticlinal structures which usually show overthrusting of the northeast limb to the southwest. Numerous smaller faults, usually normal, complicate the structural crests.

Apparently the buttress effect of the Criner Hills trend during the southwestward push of the Arbuckle orogeny existed as far southeast as Grayson County, Texas. This suggests that those structures found southeast of the Criner Hills outcrop are a continuation of the Overbrook anticline instead of the Rock Crossing as thought by some geologists.

Marietta syncline . . . The Marietta syncline, often termed the Marietta-Sherman basin, is the dominant structural feature of Love County.

The northwest - southeast trending Marietta syncline, as defined by the Wichita-Criner Hills arch on the north and the Waurika-Muenster arch on the south, first came into being after early Pennsylvanian epeirogenic movements. Presence of 15,000 ft. of lower Pennsylvanian (Springer and Dornick Hills) sediments northeast of the Criner trend and their essential absence in the syncline shows that the Pennsylvanian - upper Des Moinesian sea was approaching from the northeast. Evidence indicates the Criner barrier was finally breached in middle Deese time.

Favorable Dornick Hills generally is not considered present in the syncline; yet a section of conglomeratic limestones which measures 1,100 ft. in the Greenville area, and thinning to the northwest (450 ft. at Stockton), is considered Dornick Hills in age (Fig. 3).

Sedimentation over the entire Marietta syncline was probably not successful until late in Deese time.

The Marietta syncline, and most of Love County, continued subsiding during the whole of Hoxbar time. After deposition of the Pennsylvanian-Zuckerman limestone (Table 1), regional uplift (Arbuckle orogeny) began.

The Marietta syncline is conveniently divided into four depositional slices, each with at least one structural pattern, and the oldest necessarily the end result of at least four and perhaps more periods of adjustment.

The oldest sedimentary unit is the early Paleozoics which were deposited when Love County was a small part of a regional basin. Uninterrupted deposition of the normal lower Paleozoics continued until the Silurian-Devonian or pre-Woodford erosional period. The presence of this hiatus is evidenced by the varying thickness of Siluro-Devonian-Hunton limestone in Love County and adjoining areas.

The second sedimentary unit is sandwiched between the underlying pre-Woodford erosional surface and the overlying lower Pennsylvanian-Wichita orogeny. This unit includes Woodford, Sycamore, Caney, and Goddard formations, and possibly the Springer sandstones.

A third sedimentary unit includes most of the Pennsylvanian strata, except for the upper Virgilian and the possible exception of lower Springer material. In this unit, one formation, the Deese, has more oil-producing zones than any other of the entire column, many of which produce in Love County.

The fourth and youngest unit consists of strata deposited on the Arbuckle orogeny erosional surface. Since these are the youngest formations they are the least disturbed of the column.

The greatest and most important structural division in Love County is the pre-Atokan unconformity, or the division between sedimentary units two and three.

Structurally the pre-Pennsylvanian strata of the Marietta syncline exhibit only one anticlinal trend; this is on the southwestern flank of the Muenster arch. This trend is responsible for the slight closures found in the overlying Pennsylvanian section which have made possible the Stockton, Pike North, and Thackerville fields.

The Marietta syncline shows little faulting in the pre-Pennsylvanian section. Dunlap puts two normal faults across northern Love County which more or less parallel the northern flank of the syncline. In the far southeastern part of the county northeast of Thackerville, two normal east-west - trending faults produce the Thackerville horst. A graben structure is present in the Texas part of the Sivell's Bend area.

Recent drilling has produced a mysterious picture in far-northwestern Love County. Control in 6-6s-3w shows basal Pennsylvanian or Ordovician-McLish. A new well in 31-5s-3w, the Frankfort Oil Co. 1 Woodworth, found Pennsylvanian or Mississippian-Woodford. Lack of additional control has prevented a solution to the riddle, but it does show that there are either structures, faulting, or both to be found in the basin depths.

Other than this, the Marietta syncline shows a general absence of faulting; however, indications are strong in numerous areas of additional displacements.

Dual gas discovery completed in Panhandle

Lovell sand produced gas at a discovery well in Mocane gas area, Beaver County, Oklahoma Panhandle.

The discovery well is Petroleum, Inc., 1 Nelson Unit in C SE NW 7-2n-26eCM, 6 miles northwest of Logan and 9½ miles southeast of similar production at Laverne field. The well flowed 5,020 M.c.f.d. through 1½-in. tubing from Lovell sand perforations at 5,306-12 ft. It also flowed 5,210 M.c.f.d. from Tonkawa Pennsylvanian at 5,738-50 ft.

Other Beaver news . . . Mayflo Oil Co. has a Morrow dual-zone discovery in Beaver County, 5 miles southeast of Elmwood and 3 miles northeast of South Como field. The 1-9 Perry Jenkins, C NW SE 9-1n-24eCM, flowed open 18 M.M.c.f.d. from Morrow "L" sand at 8,032-47 ft.; 6,800 M.c.f.d. from Morrow "S-4" sand at 8,562-68 ft.

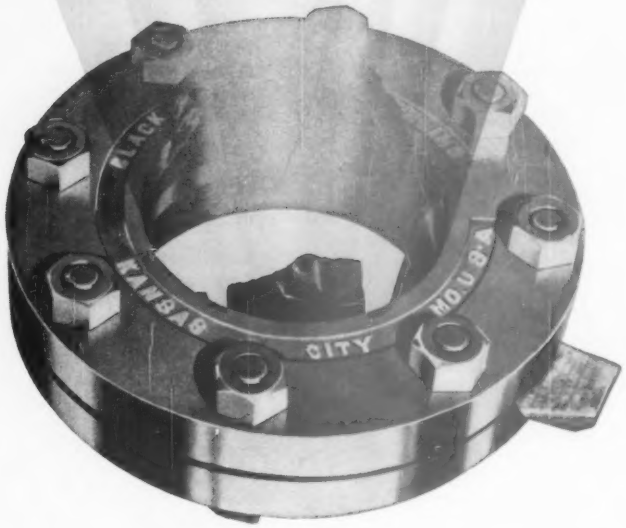
Morrow production was opened in Northeast Ivanhoe field, southeastern Beaver County, at Union Oil Co. of California 1 Morton E. Dycke, C SE NW 8-1n-28eCM. The well flowed 1,900 M.c.f.d. on 20/64-in. choke from perforations at 8,210-28 ft. This pool was opened several months ago at El Paso Natural Gas Co. 1 Oklahoma - Jackson with gas - condensate production from Cherokee Pennsylvanian. Location is 9½ miles southeast of Logan.

Nebraska's Scott Bluff may have new field

An indicated discovery for western Nebraska's Scotts Bluff County is Tom Vessels, Jr., 1 Ewing, C NE SE 26-21n-56w.

The well swabbed at the rate of 8½ bbl. of oil per hour from Dakota Cre-

This "heart-failure" can lengthen someone's life!



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taceous "J" sand perforations at 5,667-70 ft. Location is 1¼ miles northwest of one-well Vessels field.

Oklahoma's Harper taps Viola lime pay

In Oklahoma Sinclair Oil & Gas Co. has discovered the first Viola lime oil production for North Buffalo pool in Harper County.

Sinclair and others completed the 1 Shupe, C SW SW 5-28n-22w, as a three-zone producer in the multiple-zone field which was a Sinclair discovery of 1958.

The well flowed 17 bbl. of 48°-gravity oil in 7 hours from Arbuckle lime perforations at 7,607-35 ft. through a 12/64-in. tubing choke after acidizing; flowed 102 bbl. of 43°-gravity oil in 24 hours from Lansing lime perforations at 4,567-79 ft. through a ½-in. tubing choke, and flowed 100 bbl. of 42.5°-gravity oil in 10 hours from Viola lime perforations at 7,252-56 ft. through ¼-in. tubing choke after acidizing.

The 1 Shupe is the third triple completion and the twelfth producer in North Buffalo field. Seven wells were dually completed. Oil or gas is produced from six formations, including the Arbuckle, Viola, Morrow, Kansas City, Lansing, and Oswego. Gas shows have been encountered in the Chester lime of Mississippian age.

Souheast New Mexico has big new strikes

Big discovery wells in the upper Permian are still being completed in Southeast New Mexico. Sinclair Oil & Gas Co. 1 State Lea 886, 9 miles northwest of Lea townsite and 1½ miles west of Teas field, was swabbed for 293 bbl. of 29.5° oil in 12 hours, giving it a calculated daily potential of 586 bbl. of oil. Gas-oil ratio was 100:1 and there was no water.

The above test was taken on 12 ft. of perforations in the Yates sand at 3,220-32 ft. Two other Yates zones had been perforated but were packed off during the potential test. On separate tests, 3 ft. of pay at 3,195-98 ft. produced 98 bbl. of 33° oil in 4 hours, and two sets of perforations at 3,148-64 and 3,170-78 ft. produced 198 bbl. of the same gravity oil on a 5-hour swab test.

Each of the three producing zones had been treated with 500 gal. of acid. On the swab tests above, the three zones produced at hourly rates of 24, 24, and 39 bbl.

Sinclair 1 State Lea 886 is in SE NW 16-20s-33e.

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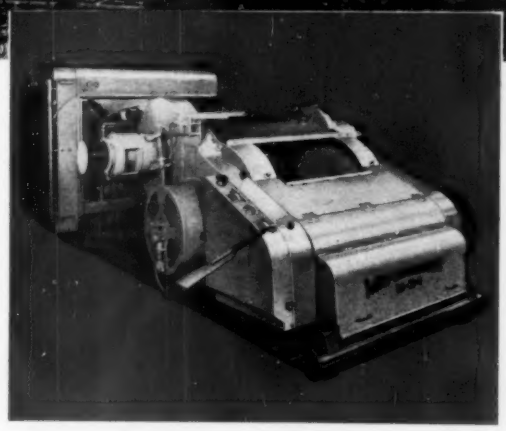

DW1-0

Thanks to a highly portable Mid-Continent U-34 Drawworks, this Pioneer Well Services' rig can drill anywhere in the rugged San Juan Basin. A single package rig when used as a skid-unit, the U-34 can also be trailer mounted with the mast. For portability—for efficiency in slim hole drilling, buy the Mid-Continent U-34.

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TOWERING CHIMNEY ROCKS loom over drilling operations in one of the busiest shallow oil plays in the southern Rockies—Horseshoe Canyon—as oil men continue to find . . .

New oil for gas country

(Photos courtesy "Atlantic" magazine.)

NORTHWESTERN NEW MEXICO'S arid, barren mesa country, long considered gas country, has sprouted oil producers by the dozens in the past 2 years.

HORSESHOE CANYON Gallup field in the San Juan basin continues to be the fastest-growing oil reservoir in northwestern New Mexico.

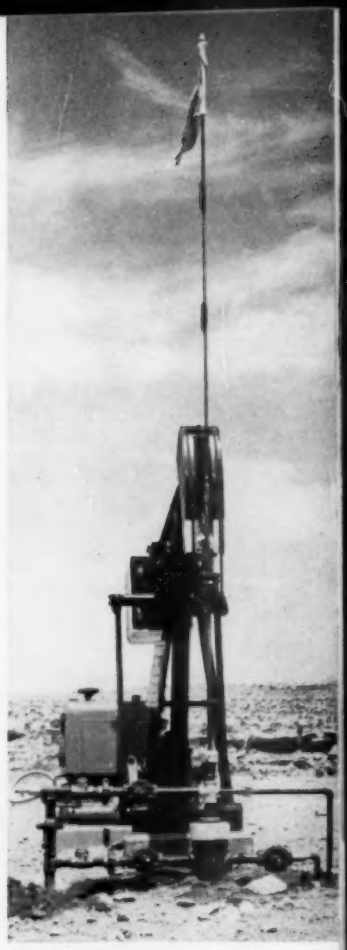
There are 290 wells in this shallow field, 209 of them making the daily allowable of 52 bbl., 81 making about 30 bbl. daily. The field's allowable output is 13,313 bbl. per day.

Regional location . . . Horseshoe Canyon Gallup field is on the northwest edge of San Juan basin in northwestern New Mexico. It lies 18 miles northwest of the city of Farmington.

The outlook . . . With easy drilling, shallow pay depths, and outlet, this field should continue to grow. The field's big success is an important part of the growing oil potential of San Juan basin, formerly a gas giant. The recent Dakota Cretaceous oil finds inside and outside Blanco gas field, the Bisti and Gallegos oil play to the south, and the promise of further exploration for oil throughout the basinal area, point San Juan up as a basin of much oil promise.

In two years, this desert area has seen 290 oil wells successfully completed

A CABLE-TOOL RIG completes this well at the north end of Horseshoe Canyon field. Rotary was used to drill the well, but cable tools were considered better and cheaper to complete the job.



FLAG atop pumper on mesa shows pumpers from distance whether unit is pumping.

ATLANTIC GEOLOGISTS check a well log from the B-17 Navaho well. Left to right are LaRoy Knott, Tommy Sheets, Landon Kelly, Doug Kloxin, Frosty Turner, Bob Kolm, Louis F. Davis, and Bob Cox.

CONTINUOUS RESEARCH

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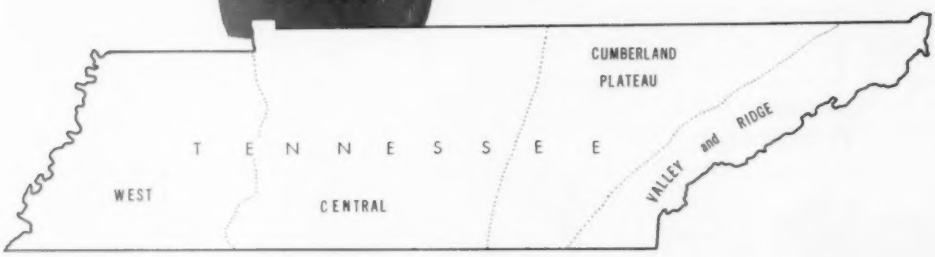
EXPLORATION OUTLOOK



Tennessee may be next big shallow-play target

WILL KENTUCKY'S shallow oil boom move south into Tennessee? This question should be answered in the next few weeks. There are 30 rigs working in the state this winter compared to only 2 last January. Operators had finished 43 wells up to Christmas, 4 of them oil producers. This compares with only 25 wells in 1958. With oil moving rapidly to the state line in Kentucky, there's no reason why there won't be oil news in Tennessee this year.

An oil centenarian

. . . has had a long, hard, and disappointing haul of it. Oil was known in the state 27 years before Titusville, but the first commercial producer wasn't finished until 1866 at Spring Creek in southern Overton County. Development of the state's oil resources was painfully slow through the years. All of the oil in Tennessee is in the northern tier of counties, but production has dropped to around 6,500 bbl. per annum. Now after a century of sprinkled drilling, we may see a new page of Tennessee oil history turned soon. Oddly enough, the state's focal point of revived exploration is in Pickett County, just northeast of the birthplace of Tennessee oil.

Kentucky border discoveries

. . . are awakening Tennessee oil hunters to the possibilities of their state's many likely oil haunts. Recent discovery of oil at a Simpson County wildcat in Kentucky, revival of old fields with water flood in Clinton County, and a rash of wildcatting in Barren, Allen, Monroe, and Cumberland counties, stirred even the majors to begin leasing land in about a dozen northern Tennessee counties. Pickett County has eight wells going, leading the parade of what is hoped to be the start of another "Green County." One well, 3 miles south of Byrdstown, is due to dig to 3,500 ft. and bottom. The shallow Trenton Ordovician and Chattanooga shale are the prime targets in Tennessee's north. Most wells are no deeper than 1,000 ft., however.

Tennessee's varied geology

. . . offers four areas of possible oil production. The state is divided into West, Central, Cumberland Plateau, and the Valley and Ridge provinces. Each is different geologically, but each has definite oil possibilities. The only thing needed is much more wildcatting and the discovery of some good reservoir rocks.

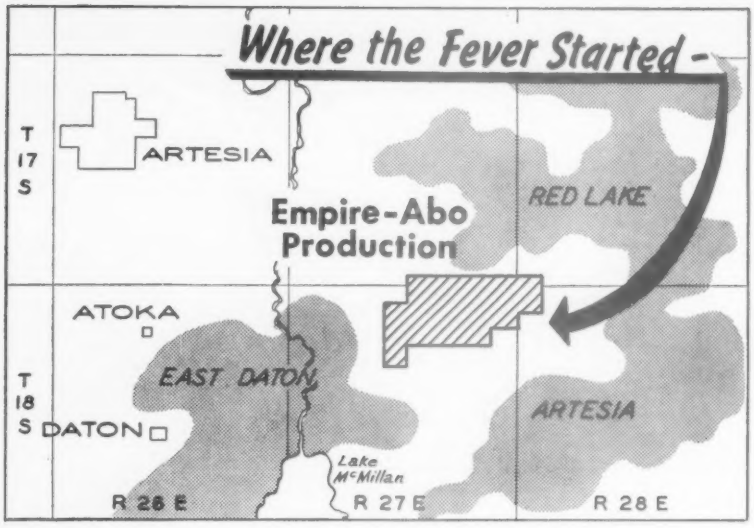
West Tennessee lies in the Mississippi embayment and west of the Tennessee River Valley. Two stratigraphic divisions here have oil hopes—the overlying Cretaceous and Eocene section, and the underlying Paleozoic rocks. The Cretaceous and Eocene strata form an asymmetrical wedge which thickens to the west from the Tennessee River to about 3,000 ft. in the southwest corner of the state. The westward dip is 25 ft. per mile, offering the possible presence of reservoir and source beds. There needs to be considerable geophysical scrutiny in this area, however, before much can be learned for the would-be driller. Geophysical work also is needed in the Paleozoic strata in the upper part of the Mississippi embayment.

Central Tennessee includes the Central basin area with the Cincinnati arch being the major structural feature. Sedimentary rocks here run from Cambrian through Mississippian. On the Nashville dome the section is about 5,000 ft., and offstructure it is more than 7,500 ft. There should be source beds here, and there are quite a few favorable structures. Drillers should look for zones of fracture porosity and intergranular porosity in the Ordovician, Mississippian, and Devonian rocks since they have produced in this province in the past. The whole central area of the state has many possibilities, but as in all untested provinces Tennessee needs more and deeper exploration.

In the Cumberland Plateau the lower part of the section is the same as in central areas of the state. There are source beds, reservoir rocks, and favorable structures here for oil. There are even more lenses in the eastern part of the state than in the central.

The Valley and Ridge province used to be condemned, but the discovery of oil at Rose Hill in southwestern Virginia puts a definite hole in the theory. There is a vast number of potential oil-producing areas here in the extreme eastern part of the state. Only time and the drill can tell.

—John C. McCaslin



CARL HOOT
District Editor

Discovery of a thick oil-bearing Abo reef 5½ miles southeast of Maljamar in west-central Lea County, New Mexico, has built a little more fire under what was a hot situation, as . . .

New Abo strike stirs reef search

OPERATORS are checking logs in existing wells in the area and are assembling drilling blocks near the new strike. Leasing is complicated by the fact that almost the entire projected course of the reef is held by shallow production.

The well that has spurred this reef search is Carper Drilling Co. and Kewanee Oil Co.'s 1-A Federal MA, in NE NW of 31-17s-33e, just south of producing limits of the old Maljamar field in Lea County.

Carper's discovery was drilled on a 1,288-acre block held by Carper, Kewanee Oil, Phillips Petroleum Co., Hudson & Hudson and S. J. Iverson. Carper expects to use one of its rigs in continuous development of the block and is reported to be moving in to drill one location southeast of the discovery for the second test.

Meanwhile 1-A Federal MA stopped drilling at 10,015 ft. and was making electrical surveys. The Wolfcamp was topped by samples at 9,510 ft., and a final drill-stem test at 9,491-9,590 ft. recovered mud only with no shows.

A 4-hour drill-stem test at 8,623-8,775 ft. recovered 110 ft. of mud and 100 ft. of free oil, with no water. At that point the well had been tested over 369 ft. of reef with five tests, two of which flowed oil ranging from 15 to 24 bbl. an hour. The first and fourth tests recovered 6,085 and 7,900 ft. of oil respectively.

New Abo drilling . . . Grover, McCurdy and Knox are reported ready to drill an Abo wildcat 4 miles east of the Carper discovery, in 35-17s-33e. Projected depth is 9,000 ft. Location is on a farmout from Ralph Nix et al.

British - American Oil Producing Co. 1 Pluma Unit, scheduled to 6,000 ft., has been located in the SE SW Section 19-18s-27e, which puts it 3 miles southwest of production in Empire-Abo field.

Status of Empire-Abo field, east of Artesia in Eddy County, where all the Abo fever started, is 70 successful Abo wells since discovery in 1957. Most of these have been drilled this year.

Fifty-six of the seventy were drilled by Pan American Petroleum Corp., most if not all of these in partnership with Hondo Oil & Gas Co. Nine other operators drilled the other fourteen wells.

Of 62 wells included in the field for the December proration schedule, 59 were granted a top allowable of 64 bbl. a day, based on a depth range of 6,000-7,000 ft. Three marginal wells were given a 62-bbl. per day allowable.

Discovery wells

COLORADO

Routt County: Pubco Petroleum Co. 1 Gassy Creek Coal Co., SE SE 26-6n-87w. IPP 105 BOPD, Niobrara discovery, new field, 5,025-5,330 ft. TD 5,330 ft.

TEXAS GULF COAST

San Patricio County: Humble Oil & Refining Co. 53 J. W. Mayo Account 1, J. B. Bryan Sur. IP 129 BOPD, ⅛-in., 27.8° GOR 715 cu. ft. per bbl., 650 psi., perf. 5,191-94 ft., Frio-Midway sand. TD 6,315 ft. New pay in Taft field.

Texaco Inc. 1 R. A. Adams, Section 56, George H. Paul Subd., Welder Ranch, Sacarias Villareal Sur., A-34, 2 miles north of Edroy. IP 14 BOPD (net), 88% water, GOR 26.9 M.c.f. per bbl., perf. 5,967-68 ft., basal Frio. TD 6,500 ft. New field 1½ miles southwest of Welhed discovery well.

TEXAS PANHANDLE

Ochiltree County: Shamrock Oil & Gas Corp. 1 W. H. Dutcher, Sec. 406, Blk. 43, H&TC Sur., 13 miles southeast of Perryton, 2¼ mile south Parnell lower Morrow gas field. IPP 175.2 BOPD, 40°, GOR 1714:1. Cleveland 7,376-90 ft. TD 10,115 ft.

F. H. Rhees

Oil Heads Into Its Best Years

. . . and there's no limit on how far a good man can go in the industry, says Rhees, Sinclair's new operations boss.

WHEN F. H. RHEES was 6 years old, he dropped a go-devil down a hole to set off nitro blasts and make some oil flow. His rig-builder father coached him.

At 15, he herded a bit-rack pickup over chug-holed Oklahoma rural roads as an emergency tool chaser.

As a young man he spent 3 years roustabouting near Burbank in the backwash of the violent oil boom days. All these experiences were the foundation for a major role as a Sinclair production man.

Rhees, a Sinclair Oil & Gas Co. director since 1950 and a vice president since 1952, has just moved up to operations coordinator.

He coordinates activities of 2,300 Sinclair employes, more than one-half of the company's personnel.

The departments he oversees include production, gas and gas products, LPG sales, engineering, property acquisitions, part interest operations, and motor transportation and mechanical maintenance. It's a versatile man's paradise, takes a lot of different doing well.

The iron-grayed, crewcut Rhees is as much a Sinclair man as they come. His father built rigs in Forest County, Pa., just a hop and skip from the Oil City and Titusville activity. The family moved west 50 years ago, and the elder Rhees closed his oil career as production superintendent for Prairie Oil & Gas Co., a Sinclair predecessor.

The intricacies and challenges of secondary recovery have been Herb Rhees' forte for a quarter century. Sinclair pioneered secondary recovery in northeast Oklahoma from 1932. Rhees was there, helping and calling signals. His combined geological and engineering talents have guided much of Sinclair's program in lifting a second crop of oil from earth.

To him, the surface hasn't been scratched in secondary-recovery methods. He believes that big upward strides are just ahead.

He puts it this way:

"We'll never have enough engineers and trained oil people to go around. What a good man can do right now and in the immediate future has no limits.

"For exploration, for exploitation, for production, for the engineered applications of oil's newest methods, there's nothing better than an engineering background. The field is wide for those who want to tackle it.

"I can't understand for the life of me why engineering and technical enrollments are down. If ever there was a time when the best of such talents were needed, it is now," he adds.

That can be jotted down also as Sinclair's pattern for the '60's. Rhees doesn't see these years as the fag end of a fabulous, technically-loaded petroleum era. To him, it's kickoff time for oil's most substantial upward surge.

Lease-house life . . . Rhees was born in Selma, Ind. He was a year old when rig building took his parents to the Bald Hill-Morris, Okla.

A lease camphouse near Delaware in the shallow Nowata fields was home the next 3 years. When he was 6, Rhees' family moved to Tulsa where he went through grade and high schools.

He drew his first pay checks as a 15-year-old high-school student for summer employment lugging tools by truck in the heyday of the Drumright, Depew, and Bristow oil plays.

A year at Wentworth Military School in Missouri, 2 years of geology at the University of Kansas, and a semester of petroleum courses at University of Tulsa followed. Rhees then applied his book learning to the field, and 3½ years of Burbank roustabouting delayed his final year of petroleum engineering studies at the University of Oklahoma. He returned to Prairie Oil & Gas, now Sinclair, for a lifelong hitch of work, in 1930.

In 1930, he married Dorothy Veasey. Her father, James A. Veasey, is recognized as one of petroleum's most astute conservationists.

Rhees also is a director of Sinclair Canada Oil Co. and Sinclair Research Laboratories, Inc. He returned to the classroom in 1953 for Harvard University's advanced management course.

"I've learned plenty from a grand bunch of super-superiors and have learned as much from those who have worked with and alongside me," he says.

"So many people never have a chance to show what they can do. I've been lucky. I guess I just happened to be around when opportunity knocked and for some reason, had no inhibitions about tackling a new job."

He's gearing his sights now for a never-ending search for hidden talents in people. When these storehouses of talent are released, he's sure oil's fortunes are bound to pick up speed.

Personals

W. G. Osborne, assistant to the natural gasoline division manager for Arkansas Fuel Oil Corp., has been promoted to manager, natural gasoline division. He succeeds **M. F. Wirges,** who was recently named chief engineer of the company. **W. H. Heyland,** superintendent of operations, will succeed Osborne. **J. E. Beavers,** superintendent of the May plant, Kingsville, Tex., has been promoted to superintendent of operations and transferred to Shreveport, La. **M. R. Smith,** construction engineer in Shreveport, will succeed Beavers in Kingsville. Osborne has been with the company since 1935. He had been assistant to the natural gasoline division manager since 1957.

OSBORNE

Paul Bennett, formerly Atlantic Refining Co. regional production engineer in Tulsa, has joined Kerr-McGee Oil Industries, Inc., in Calgary as valuation engineer.

Dr. L. I. Griffin, Jr., assistant director at Esso Standard Oil Co.'s Baton Rouge, La., research laboratories, has taken on duties for patents and technical information formerly handled by **Dr. John J. Owen.** Owen has retired after 20 years with the company. Griffin will continue with his responsibilities in fuels research and development.

Stuart P. King, senior vice president of Tennessee Argentina, S. A., subsidiary of Tennessee Gas Transmission Co., has taken over as manager of Argentine operations. **Marshall A. Jeffers,** vice president of Tennessee Argentina, has been named production manager for Argentine operations. Both will headquarter in Buenos Aires. King will continue as a vice president of Tennessee Gas & Oil Co., TGT's exploration and production division. Tennessee Argentina has an exploration and development contract with Yacimientos Petroliferos Fiscales, government oil agency, for operations on Tierra del Fuego.

KING

Guy Andersen, formerly with Pure Oil Co. in Newark, Ohio, has been transferred to Reed City, Mich., as district superintendent.

J. E. Pauley, foreman in Ohio Oil Co.'s Midland, Tex., production district, has been appointed safety engineer for the Houston division. He succeeds **R. E. Simon,** who has retired.

Jeff Good, Fort Sumner, N. M., has been named president of Shelton-Warren Oil Co., Roswell, N. M. Other new officers include **Gordon McMeen,** Roswell, executive vice president; **C. L. Yeatman,** Coleman, Tex., vice president, operations; **Ross V. Seeton, Jr.,** Edgemont, S. D., vice president, mining; and **Mansfield Tweedy,** Roswell, secretary-treasurer.

G. D. (Dan) Almen, Jr., has been elected a vice president of Sinclair Oil Corp. Almen is also a director and vice president of Sinclair Oil & Gas Co. and headed the company's Houston and Midland, Tex., offices before moving to parent company operations in New York recently. In the new post Almen will assist **F. A. Bush,** vice president and chief geologist, in supervising foreign and domestic exploration and production activities.

G. Wayne Wimberley, supervisor of the reforming and extraction area at Tidewater Oil Co.'s Delaware City, Del., refinery, has been named superintendent of alkylation, polymerization, reforming, and desulfurizing. **William W. Burleigh,** supervisor of the desulfurizing and hydrogen area, will succeed Wimberly. **Charles A. Slikas,** technical foreman of the desulfurizing and hydrogen area, moves up to succeed Burleigh as supervisor of the area. **Joseph A. Dunphy, Jr.,** technical foreman in the oil dispatching department at Delaware, has been named assistant coordinator in the New York office. **Robert E. O'Sullivan,** acting technical foreman of the utilities and sulfur recovery area, has been named technical foreman in oil dispatching. **Robert O. Pearson,** engineer, has been appointed technical foreman, desulfurizing and hydrogen area. **Charles S. Joanedis,** formerly a staff engineer in desulfurizing and hydrogen area, has been named staff assistant to the refinery superintendent. Joanedis succeeds **Donald M. Warren,** now staff engineer in the reforming and extraction area. **John M. Wright,** staff engineer, has moved to the desulfurizing and hydrogen area from the reforming and extraction area.

K. W. Brill, a vice president of Continental Oil Co. in New York, has been appointed assistant general manager of the Rocky Mountain region. He will headquarter in Denver. **J. P. Malott,** formerly assistant general manager, Rocky Mountain region, has been promoted to general manager of

BRILL

MALOTT

the company's western region. He will headquarter in Los Angeles. **Olen Lane** will continue as vice president of Continental in Los Angeles. He will devote most of his time to industry affairs. Brill was Rocky Mountain region exploration manager at one time. He also has been central region general manager in Oklahoma City and assistant southern region general manager in Houston. He moved to New York as assistant to the vice president in 1957 and was elected a vice president in 1958. Malott had been assistant general manager for the Rocky Mountain region since 1958. He had been regional engineer, assistant manager of the production department, and production manager in Houston before that time.

Joe Stewart, formerly with Esso Research, Ltd., London, has been appointed assistant director of Esso Research & Engineering Co.'s chemical research division. He succeeds **Paul Smith,** who was recently appointed assistant director of a new long-range research division. Stewart has been with Esso since 1945. He had been on assignment with the English company since 1958.

Everest E. Wible, formerly Wichita district exploration manager for Aurora Gasoline Co., has been transferred to Tulsa as special representative in the production department for Ohio Oil Co. Aurora's exploration and production activities in the area were taken over by Ohio after merger of the companies. In other Ohio changes, **Hill Elliott,** petroleum engineer in Tulsa, has been promoted to district reservoir engineer in Bakersfield, Calif. **Tony Snow,** Tulsa district geologist, has been transferred to Shreveport, La., as district geologist. **Chester Dill,** formerly in the Tulsa land department, has been appointed district land man in Oklahoma City.

▶▶▶ Personals

Paul F. McBride, general superintendent of operations for Pacific Northwest Pipeline Corp. since 1958, has been named operations manager of Transwestern Pipeline Co. In other appointments for the new pipeline, **William A. Koros,** formerly assistant to the vice president, rate department, for the Charleston group companies of Columbia Gas System, has been named controller and assistant treasurer and secretary. **Ben A. Copass, Jr.,** sales representative for Humble Oil & Refining Co., has been appointed manager of gas purchase contracts for Transwestern. **Leslie M. Fisher,** formerly plant superintendent of Carthage Co.'s Carthage, Tex., plant, has been named superintendent of the Puckett gas purification plant, Fort Stockton, Tex. Transwestern's Texas - to - California line is expected to be ready for operation by the middle of the year.

McBRIDE

F. Marshall Tarr, marketing department credit and collections manager for Standard Oil Co. (Ohio), has been named Toledo division manager. He succeeds **Clayton G. Bittner,** who has taken early retirement.

G. Curtis Mayes, assistant to the joint interests manager of Mobil International Oil Co., has moved up to joint interests manager. He succeeds **Charles W. Boughton,** who will retire February 1 after 33 years with the Mobil companies.

Clarence W. Dole, assistant manager of distribution in Mobil Oil Co.'s supply and distribution department, has moved up to manager of distribution. **William F. Kirk,** formerly manager of General Petroleum Corp.'s economics department, has been named manager of the programs and analysis section in Mobil Oil's supply and distribution department. He will headquarter in New York.

Bagher Mostofi, managing director of Iran Oil Co., and **Manouchehr Farmanfarmaian,** chairman of Iran-Canada Oil Co., have been elected directors of National Iranian Oil Co. Mostofi has been a director of Iran Oil, exploration subsidiary of NIOC, since 1949, and managing director since 1954. Farmanfarmaian became a director of Iran Oil Refining Co. in 1954 and chairman of Ircan, a company jointly formed by NIOC and Sapphire Petroleum, Ltd., in 1959.

John M. Hoffman, associate petroleum engineer with Ohio Oil Co., has been transferred to Hobbs, N. M., from Bay City, Tex.

D. C. Antrobus, N. E. Blackwell, R. R. Cecil, R. E. Fuchs, and **J. A. Hanan** have joined the technical staff of Esso Standard Oil Co.'s Baton Rouge, La., research laboratories.

John Ramser has been appointed research associate in the research and development department of Atlantic Refining Co. Ramser has been with Atlantic since 1938.

W. W. Watkins, district production superintendent for Shell Oil Co. in McAllen, Tex., has been transferred to Victoria, Tex., in the same capacity.

Edmund E. McCurtain, district engineer in Houston for British-American Oil Producing Co., has been appointed drilling unit and proration supervisor, Dallas. **Carroll B. Cox,** field engineer for British-American in Lafayette, La., has been promoted to district engineer. **Stephen C. Goodnough, Jr.,** production engineer in Ventura, Calif., for the company, has been named field engineer in Kimball, Neb. **Frank J. Stofac,** engineer's assistant in Kimball, has been promoted to junior production engineer, Denver.

William A. Dennison, manager of the economic research section of American Petroleum Institute's committee on public affairs, has been named director of API's department of statistics. He succeeds **Fred Van Covern.** Van Covern was scheduled to retire January 31 but has agreed to stay with the association for an indefinite period. **Peter Griskivich,** assistant manager of the economic research section, will succeed Dennison as section manager.

Walter O. Miller, superintendent of Continental Oil Co.'s Baltimore petrochemical plant, has been promoted to superintendent of the company's alcohol plant now under construction in Lake Charles, La. Miller will be succeeded in Baltimore by **T. J. Karolenko,** now superintendent of the Chicago and Hammond, Ind., petrochemical plants. **J. H. McGinnis,** assistant superintendent of the Chicago plant, will take over as superintendent in Chicago and Hammond. **E. J. Karwacki,** Hammond, will be assistant superintendent of both the Hammond and Chicago plants. The Lake Charles plant is scheduled for completion in early 1961.

Earl E. Mayo, vice president of Southern Pacific Pipe Lines, Inc., has retired.

Norman A. Olansen, engineering assistant in the petroleum department of Chase Manhattan Bank, has been appointed an assistant treasurer in the department. Olansen was with Texaco Inc. before joining Chase Manhattan in 1955.

William Sparrow, Phillips Petroleum Co., has been elected president of the Central Canada Oil Scouts' Association. Other officers will be **D. A. Drummond,** Devon Palmer Oils, Ltd., vice president; **Clifford L. Fiesel,** Canadian Devonian Petroleums, Ltd., secretary; and **E. F. Lee,** Shell Oil Co. of Canada, Ltd., treasurer. Members of the executive committee include these officers and **J. P. Switly,** Texaco Exploration Co., and **C. S. Thompson,** Western Leaseholds, Ltd.

George D. Myers, formerly superintendent of Ashland Oil & Refining Co.'s two Catlettsburg, Ky., refineries, has been named general operating superintendent of refineries for the company. He will headquarter in Ashland, Ky. **Milton R. Bradley,** operating superintendent of the Canton, Ohio, refinery, will succeed Myers in Catlettsburg. **John R. Watts,** process supervisor in Catlettsburg, will succeed Bradley as operating superintendent in Canton. Myers was with Houdry Process Corp. before joining Ashland in 1951 in Canton. He was operating superintendent, Canton refinery, before moving to Catlettsburg in 1955 as superintendent. Bradley has been with Ashland since 1938, Watts, since 1948.

MYERS

Ken Manes, field man with Halliburton Oil Well Cementing Co. in Seminole, Okla., has been promoted to petroleum engineer and transferred to Tulsa.

Dick Zimmerman, district geologist with Petroleum, Inc., is newly elected president of the Liberal, Kans., Geological Society. Other new officers are **Russell Clausing,** Panhandle Eastern Pipe Line Co., vice president; **Larson Drake,** Ohio Oil Co., treasurer; and **John Mason,** Pan American Petroleum Corp., secretary.

Personals

J. E. Gosline, vice president and assistant to the president of The California Co., has been elected president of Standard Oil Co. of Texas. He succeeds **K. H. Shaffer,** who has moved up to chairman and who is scheduled to become president of The California

GOSLINE

SHAFFER

Co. sometime before June 1. **H. C. Teasdel,** Calco president, retires on that date. Teasdel will move up to chairman of the company before his retirement. The California Co. and Standard of Texas are subsidiaries of Standard Oil Co. of California. Calco is the producing, refining, and marketing subsidiary for Louisiana, the southeastern, eastern, central, and Rocky Mountain states. Standard of Texas covers Texas and New Mexico. The board chairmanship of Standard of Texas which Shaffer will take over has been vacant 2 years.

William A. Lockwood, assistant vice president in the petroleum department of First National City Bank of New York, has been appointed a vice president.

J. D. Nitzschke, superintendent of American Oil Co.'s Providence, R. I., terminal, has been appointed assistant manager of Amoco's terminal department. **M. Hanewich,** assistant superintendent in Providence, will succeed Nitzschke there.

Dr. E. G. Foehr has been appointed senior research chemist in the greases and industrial lubricants division of California Research Corp.'s Richmond, Calif., laboratory. Foehr has been with Cal Research since 1944. Also at the Richmond lab, **Dr. W. C. Buss** and **D. F. Mordant** have joined the company as research chemists. **Dr. A. R. Van Kleeck, L. M. Davis,** and **Larry Mank** have joined the company as research engineers. At the La Habra, Calif., laboratory, **Dr. Don D. Thompson** and **Dr. Angelos V. Patsis** are new research chemists, and **Dr. Lawrence W. Jordan, Jr.,** has joined the company as research engineer.

Franklin Wheeler, formerly reservoir engineer with Atlantic Refining Co. in Tulsa, has joined Sinclair Oil & Gas Co., Tulsa, as intermediate reservoir engineer.

John R. Penn, Jr., has been named a director of Texas Pacific Coal & Oil Co. Penn, a Fort Worth investor, is a director of Independent Petroleum Association of America and Texas Mid-Continent Oil and Gas Association. He is the son of former Texas Pacific president **J. Roby Penn.**

Jim Shackelford, geologist with Kingwood Oil Co., has been promoted to division geologist in Mount Vernon, Ill. **C. A. Robinson** has joined the company as engineer. **John G. Woolley,** formerly Kingwood division manager in Mount Vernon, has resigned to become a consulting geologist.

Sam Regier, engineer in Warren Petroleum Corp.'s manufacturing division, Tulsa, has been assigned to Kuwait Oil Co., Ltd., as a senior gas engineer. Regier will headquarter in London where he will be in charge of designing LPG recovery, storage, and loading facilities for Kuwait. He will later supervise construction of the facilities in Kuwait.

Glen Anderson, Douglas J. Miles, and **Thomas H. Philpott** have been elected vice presidents of Olin Oil & Gas Corp. Anderson, Miles, and **Earl C. Brimberry** have been elected vice presidents of Olin Gas Transmission Corp., a subsidiary. **Walter F. O'Connell** has resigned as vice president and has been appointed assistant treasurer of both companies.

R. V. Lynam, first engineer at Tidewater Oil Co.'s Brito pump station near Dos Palos, Calif., has retired after 41 years with the company.

Otha Hatfield, Hatfield & Jackson Oil Co., Lawrence, Kans., has been elected president of the Kansas Oil Men's Association. He succeeds **Dean Spencer,** Oakley, Kans.

Jerry Maloney, Universal Oil Co., Wichita, recently was elected 1960 president of the Wichita Oil Men's Club, local marketing group. He succeeds **Harold Johnson,** Killion Oil Co.

Winfield Givens, manager of Sun Oil Co.'s land department, has retired after 40 years with the company. Givens has also been a director and executive vice president of Sun's eight foreign production subsidiaries.

Charles R. Yarbrough, natural gas superintendent of Mobil Oil of Canada, Ltd., has been named natural gas manager for Mobil Oil Co.'s exploration and producing department. He will headquarter in New York. Yarbrough has been with Socony Mobil companies since 1948. He had been with the Canadian company since 1958.

A. A. Glueck, Shell Oil Co. construction and maintenance foreman in Quitman, Tex., has been promoted to McAllen, Tex., district production foreman. **R. E. Wyman,** exploitation engineer, has been transferred from Shell's Pacific Coast area to the Houston area. **J. R. Buchanan,** junior mechanical engineer, has been promoted to mechanical engineer in the Houston division.

Deaths

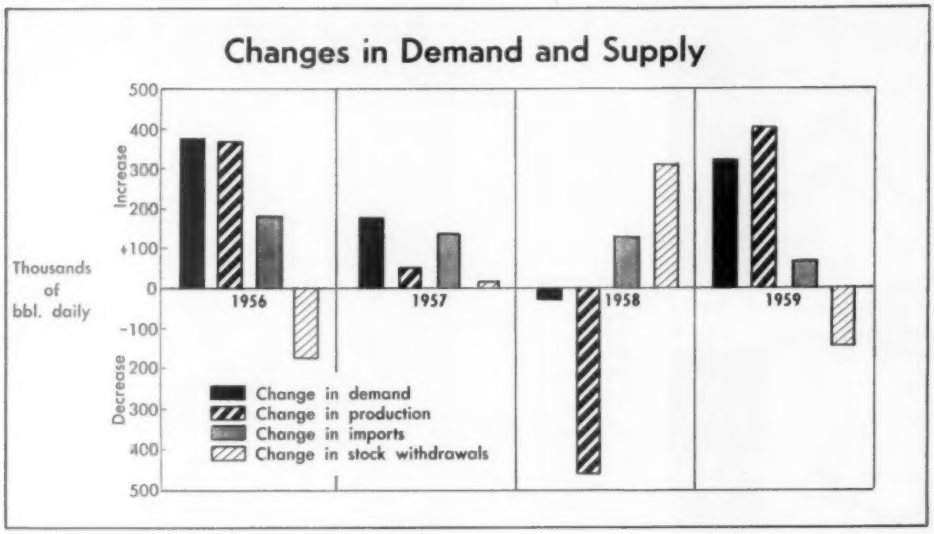
Harry V. Tomlins, 62, retired tax and insurance supervisor for British-American Oil Producing Co., died December 23 in Dallas. Tomlins was with B-A 23 years before retiring in 1954.

Walton Young, 92, pioneer California oil man, died December 25 in Los Angeles. Young retired as a supervisor with Standard Oil Co. of California in 1927 after almost 40 years with the company.

John Caller James, 38, vice president of Cameron Operating Co. and an officer of Cane Drilling Co., Natchez, Miss., died December 23 in a Natchez hospital after a short illness.

Harley C. Stevens, 59, internationally known consultant, died December 27 in his San Francisco home after a heart attack. Stevens was head of the tax department of Standard Oil Co. of California at one time. He later helped negotiate right-of-way concessions through Middle Eastern countries for Tapline, and played a leading part in negotiating a Neutral Zone concession for American Independent Oil Co. He resigned as vice president of Aminoil in June.

Clarence H. Taylor, 81, retired manager of rentals for Gulf Oil Corp., died December 28 in a Tulsa hospital. Taylor had been with Gulf and its predecessors for 38 years before his retirement in 1949.



Crude output will be up in '60

BY JOHN C. CASPER

CRUDE PRODUCTION in a given year is influenced by the supply-demand balance of the previous year. Reduced production and big stock withdrawals in 1958 accounted for part of the production increase in 1959. Crude production is also influenced by imports, gas-liquids production, and the growth in demand for petroleum products. The 1959 supply-demand balance will be a factor in 1960 production.

Before evaluating the changes in 1959, let's take a look at another unusual year. The largest annual demand gain in the history of petroleum came in 1955, but that demand did not produce a record increase in production. The record production gain was in 1951.

Total demand in 1955 showed a gain of 712,000 bbl. daily over 1954. Since stocks were at reasonable levels, there was no need for big inventory changes. The gain in supply approximated the demand increase. Crude and gas-liquids production moved up by 544,000 bbl. daily despite an import gain of 196,000 bbl. daily. Part of the big production record in 1951 was due to a drawdown of inventories in 1950, making it possible to increase stocks in 1951.

Here is a review of the changes for 1959. Total demand for petroleum products gained about 315,000 bbl. daily over 1958. This represents a relative increase of about 3.4%.

These volumetric and percentage gains look better than they really are. They are calculated from the totals for 1958 which were below par. There have been only three annual decreases in total demand since the end of World War II, and the decrease of 28,000 bbl. daily in 1958 was the largest of the three.

So we start by measuring the volumetric and percentage gains for 1959 from a low base. Even with this advantage, the gain for the year is slightly less than the postwar average. The demand gain for 1959 was 3.4% against an average of 4.3% since the end of the war.

Compared with the 315,000-bbl.-daily gain in demand for 1959, production was up 400,000 bbl. daily for the year and imports gained about 60,000 bbl. daily. This wide variation in supply-demand gains is due to the fact that no part of demand was supplied from inventories in 1959 in contrast with withdrawals of 140,000 bbl. in 1958.

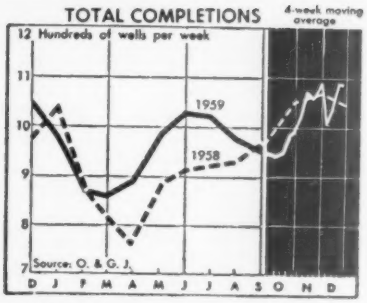
Most of the published forecasts for 1960 call for an increase in demand of about 4.0% which would amount to about 385,000 bbl. daily. Since there was little or no addition to inventories in 1959, producers and refiners may run as much as 25,000 bbl. daily to storage in 1960. On this basis, total new supply for the year will show a gain of 410,000 bbl. daily.

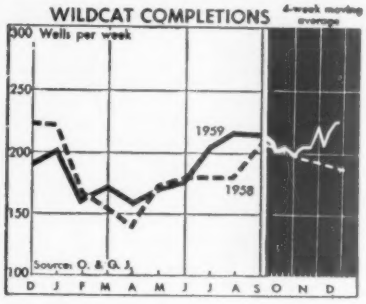
Even under control, imports may increase as much as 40,000 bbl. daily. Production of gas liquids probably will show a gain of at least 35,000 bbl. daily. These comparisons seem to indicate an increase in crude production amounting to about 335,000 bbl. daily.

A quick look at the highlights

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,138,760	DOWN	29,850	UP	7,835
Crude stocks	256,396,000	UP	2,753,000	DOWN	6,465,000
Completions	1,130	DOWN	51	DOWN	93
Refinery runs	8,266,000	UP	195,000	UP	101,000
Gasoline stocks	184,045,000	UP	1,207,000	UP	2,410,000
Kerosine stocks	27,080,000	DOWN	115,000	UP	925,000
Distillate stocks	151,441,000	DOWN	4,754,000	UP	21,031,000
Residual stocks	50,451,000	DOWN	2,025,000	DOWN	11,178,000
Four-product stocks	413,017,000	DOWN	5,687,000	UP	13,188,000
Total imports	1,737,600	DOWN	38,100	DOWN	294,000

DRILLING





Active Rotary Rigs

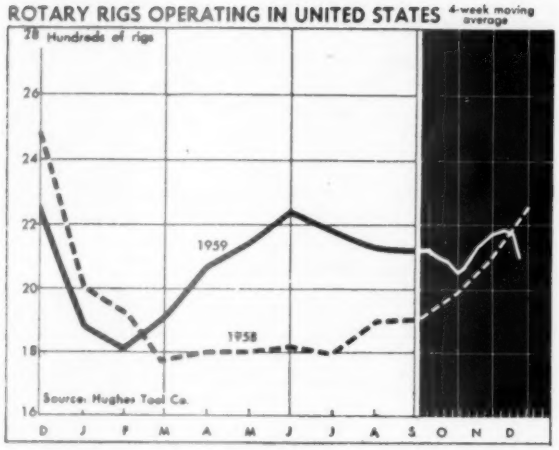
	12-28-59	12-21-59	12-29-58
Alabama	5	5	10
Arkansas	13	13	24
Arizona	0	0	0
California	87	89	85
Land	80	83	(*)
Offshore	7	6	(*)
Colorado	39	43	38
Florida	1	1	0
Land	1	1	0
Offshore	0	0	0
Illinois	33	41	49
Indiana	7	7	7
Iowa	1	0	3
Kansas	139	160	151
Kentucky	10	10	8
Louisiana	297	307	325
North	32	42	36
S. Inland waters	113	110	138
S. Land	98	101	113
Offshore	54	54	38
Maryland	0	0	2
Michigan	41	42	9
Mississippi	77	79	65
Missouri	1	0	1
Montana	22	23	19
Nebraska	29	27	20
Nevada	0	0	0
New Mexico	113	115	97
New York	0	0	0
North Dakota	30	31	32
Ohio	3	3	2
Oklahoma	194	238	234
Oregon	0	0	0
Pennsylvania	14	13	9
South Dakota	4	4	0
Texas	655	760	866
S. Inland waters	6	8	6
S. Land	175	214	180
Offshore	0	0	1
North-East	165	193	189
West Central	210	229	326
West	99	116	164
Utah	30	30	34
Washington	1	1	0
West Virginia	4	3	3
Wyoming	63	72	78
Total U. S.	**1,913**	2,117	2,171
Western Canada	222	218	193
Eastern Canada	1	1	0
Grand total	2,136	2,336	2,364

Hughes Tool Co. report. *Comparisons not available due to change in method of reporting.

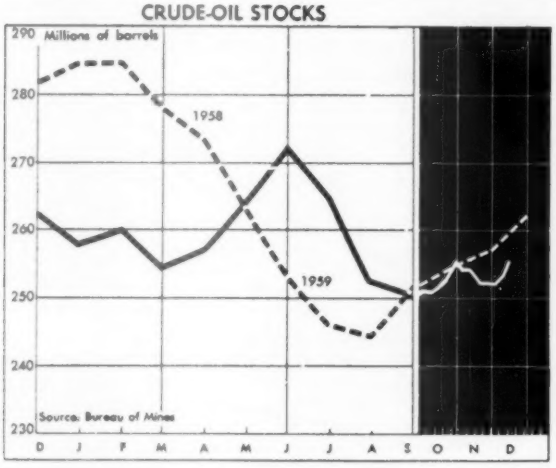
WEEKLY WELL COMPLETIONS . . . WEEK ENDED DECEMBER 26, 1959

	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1959	1958	Total	Crude	Cond.	Gas	Dry	1959	1958
Alabama	1	0	0	0	1	0	1,590	96	76	0	0	0	0	0	23	30
Arizona	1	0	0	0	1	0	3,680	27	.....	1	0	0	0	1	25	.....
Arkansas	13	8	0	0	5	0	41,107	842	836	1	0	0	0	1	146	163
California	36	20	0	1	13	2	141,726	1,529	1,476	10	1	0	0	9	404	368
Colorado	23	5	0	4	14	0	113,364	785	836	12	1	0	1	10	443	485
Illinois	45	27	0	0	17	1	99,511	2,332	2,419	5	1	0	0	4	388	449
Indiana	19	7	0	0	11	1	26,349	865	877	8	1	0	0	7	296	307
Kansas	51	24	0	5	21	1	196,567	3,912	4,022	14	2	0	0	12	1,052	844
Kentucky	131	101	0	17	12	1	136,748	3,323	2,137	8	0	0	0	8	373	176
Louisiana	90	39	8	6	37	0	668,295	3,780	3,523	11	0	0	0	11	504	531
North	40	16	0	5	19	0	173,310	1,517	1,384	7	0	0	0	7	235	243
South	44	18	8	1	17	0	439,803	1,853	1,720	4	0	0	0	4	254	261
Offshore	6	5	0	0	1	0	55,182	410	419	0	0	0	0	0	15	27
Michigan	7	5	0	0	2	0	26,136	644	436	0	0	0	0	0	180	145
Mississippi	19	8	2	1	8	0	179,883	645	398	10	1	1	1	7	283	174
Montana	12	5	0	0	7	0	39,214	343	338	3	0	0	0	3	119	136
Nebraska	14	3	0	0	11	0	87,789	894	728	8	1	0	0	7	401	348
New Mexico	42	22	0	7	13	0	161,724	2,091	1,910	8	0	0	0	8	261	266
West	11	3	0	7	1	0	49,702	908	937	1	0	0	0	1	65	103
East	31	19	0	0	12	0	112,022	1,183	973	7	0	0	0	7	196	163
New York	0	0	0	0	0	0	0	279	544	0	0	0	0	0	22	44
North Dakota	11	5	1	0	5	0	68,298	432	442	4	1	0	0	3	82	135
Ohio	39	13	0	8	16	2	73,404	1,102	1,049	6	1	0	1	4	38	23
Oklahoma	41	13	1	1	26	0	178,836	5,303	6,354	16	3	1	0	12	827	854
Pennsylvania	0	0	0	0	0	0	0	581	573	0	0	0	0	0	21	21
South Dakota	1	1	0	0	0	0	8,581	23	.....	0	0	0	0	0	10	.....
Texas	455	238	30	23	159	5	1,898,896	18,520	18,065	87	3	3	2	79	3,523	3,634
District 1	29	10	0	1	18	0	82,658	1,077	996	11	0	0	0	11	329	367
District 2	16	3	4	1	8	0	104,405	797	726	6	0	0	0	6	233	196
District 3	48	23	9	2	14	0	309,635	1,192	1,320	8	1	2	0	5	234	284
District 4	32	6	7	2	17	0	169,356	1,340	1,160	15	0	1	1	13	355	351
East	37	20	2	0	15	0	146,310	1,246	1,220	9	0	0	0	9	252	332
District 7-B	79	39	0	5	33	2	223,071	2,625	2,575	19	1	0	1	17	694	699
West	110	83	4	1	22	0	543,058	5,491	5,153	8	0	0	0	8	744	706
District 9	71	37	1	1	29	3	173,319	3,485	3,585	9	0	0	0	9	573	573
District 10	33	17	3	10	3	0	147,084	1,267	1,330	2	1	0	0	1	109	126
Utah	12	4	0	3	5	0	58,590	308	383	0	0	0	0	0	88	84
West Virginia	33	2	0	13	3	15	104,893	803	756	0	0	0	0	0	28	22
Wyoming	19	4	0	2	13	0	105,405	974	762	13	1	0	1	11	371	259
Misc. (Tenn.)	15	1	0	0	14	0	8,066	108	94	11	0	0	0	11	69	84
Total U. S.	**1,130**	555	42	91	414	28	4,428,652	50,541	49,034	**236**	17	5	6	208	9,977	9,582
Prev. week	1,181	630	35	81	417	18	4,712,265	.....	.....	246	23	5	12	206	.....	.....
Cum. 1959	50,541	25,251	1,252	3,732	18,906	1,400	207,347,349	.....	.....	9,977	878	113	329	8,657	.....	.....
Cum. 1958	49,034	24,150	1,127	3,629	18,761	1,367	197,278,869	.....	.....	9,582	919	158	266	8,239	.....	.....
Western Canada	0	0	0	0	0	0	0	2,357	2,449	0	0	0	0	0	656	638

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	12-19-59	12-12-59	12-20-58
Pennsylvania	2,382	2,384	2,693
Other Appalachian	1,986	2,077	1,628
Illinois, Indiana, Michigan	9,743	10,258	10,004
Nebraska and North Dakota	3,214	3,294	2,475
Kansas	10,064	9,381	10,348
Oklahoma	16,580	15,947	16,762
Arkansas	2,066	2,231	2,266
Louisiana	17,998	17,933	16,991
North	3,538	3,605	2,931
South	14,460	14,328	14,060
Mississippi, Alabama, Florida	2,126	2,240	2,272
New Mexico	8,226	8,397	8,446
Texas	112,542	111,310	116,543
East Texas	8,147	7,954	8,563
West Texas	53,596	52,813	58,111
Texas Gulf	21,047	20,812	19,813
Other Texas	29,752	29,731	30,056
Wyoming	17,036	16,916	13,132
Other Rocky Mountain	9,893	9,697	9,462
California	28,698	28,726	33,857
Foreign	†13,842	12,852	15,982
Total	**256,396**	253,643	262,861

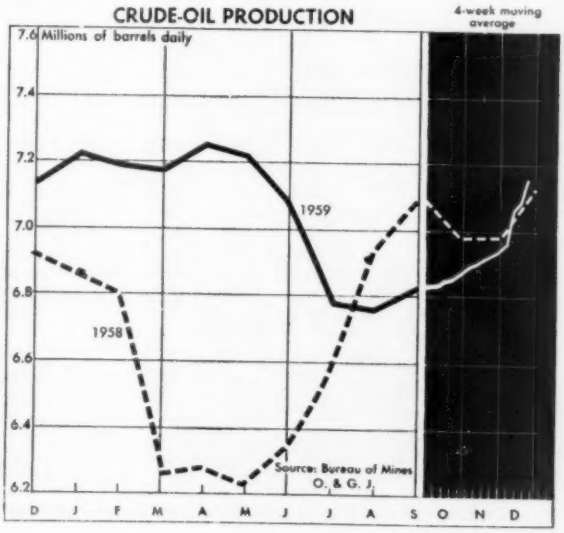
*Bureau of Mines. †Includes 4,968,000 bbl. in California.

DAILY AVERAGE PRODUCTION FOR WEEK

	December 26, 1959			Dec. 19
	Crude oil	Lease condensate	Total	total
Alabama	15,700		15,700	15,500
Arkansas	81,200	160	81,360	83,300
California	839,300		839,300	838,400
Colorado	129,600		129,600	127,000
Eastern	41,800		41,800	41,000
Florida	1,170		1,170	1,170
Illinois	217,600		217,600	220,300
Indiana	30,800		30,800	32,100
Kansas	†331,500		†331,500	†334,760
Kentucky	75,900		75,900	75,500
Louisiana	928,000	117,800	1,045,800	1,047,000
North	107,000	5,800	112,800	114,000
South	821,000	112,000	933,000	933,000
Michigan	34,400		34,400	34,400
Mississippi	140,920	5,050	145,970	145,970
Montana	79,800		79,800	80,000
Nebraska	63,200		63,200	63,900
Nevada	100		100	100
New Mexico	289,600	6,500	296,100	296,100
North Dakota	59,000		59,000	56,700
Oklahoma	†541,200		†541,200	†566,200
Texas	2,566,000	81,200	2,647,200	2,647,200
Dist. 1	43,000	3,000	46,000	46,000
Dist. 2	110,000	8,800	118,800	118,800
Dist. 3	334,000	38,000	372,000	372,000
Dist. 4	180,000	9,800	189,800	189,800
Dist. 5	26,000	400	26,400	26,400
Dist. 6	107,000	9,500	116,500	116,500
East Texas field	141,000		141,000	141,000
Dist. 7-B	128,000	180	128,180	128,180
Dist. 7-C	125,000	3,320	128,320	128,320
Dist. 8	1,059,000	5,000	1,064,000	1,064,000
Dist. 9	205,000	2,200	207,200	207,200
Dist. 10	108,000	1,000	109,000	109,000
Utah	115,100		115,100	117,600
Wyoming	345,800		345,800	344,000
Others	‡360		‡360	‡410
Total U. S.	6,928,050	210,710	**7,138,760**	7,168,610
Change from prev. week down			**28,850**	
Canada	††¶		††¶	†562,400
Total U. S. prod., Jan. 1-Dec. 26				§2,536,151,000 bbl.
Same period last year (crude plus cond.)				*2,413,072,550 bbl.

*Includes 57,545,180 bbl. condensate. †Week ended previous Monday. ‡Arizona, South Dakota and Washington. §Revised. ¶Data delayed.

CRUDE-OIL PRODUCTION



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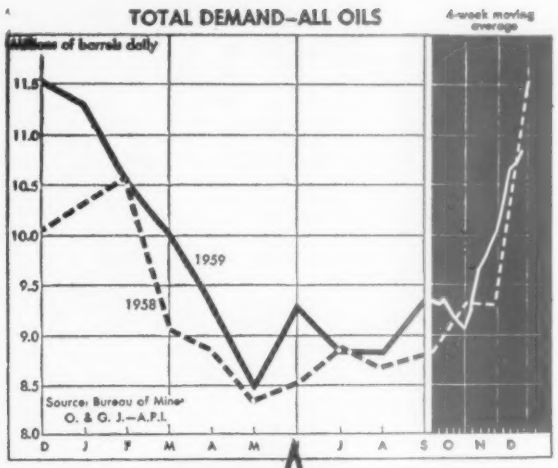

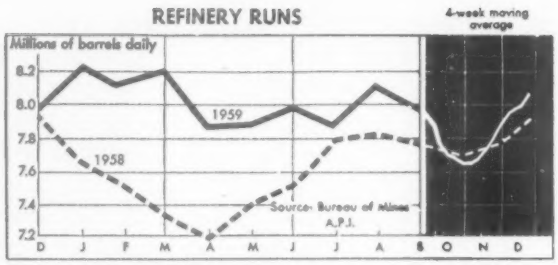

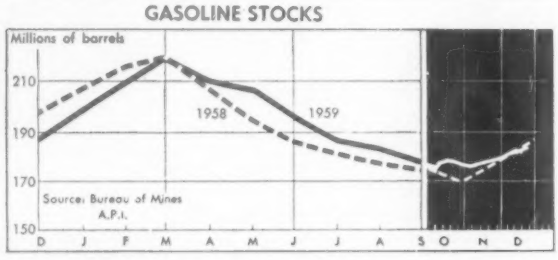

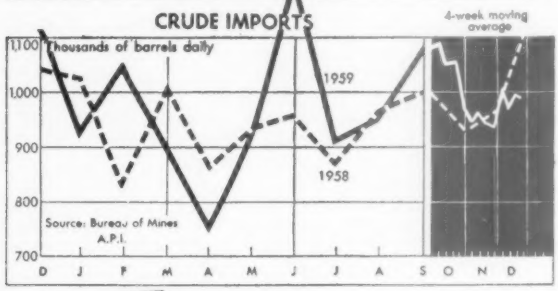

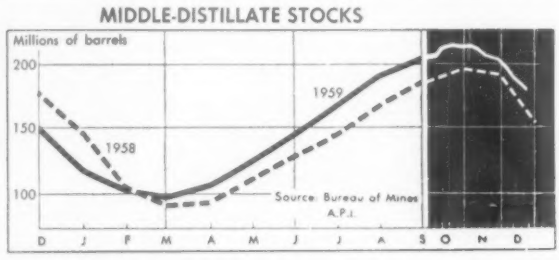

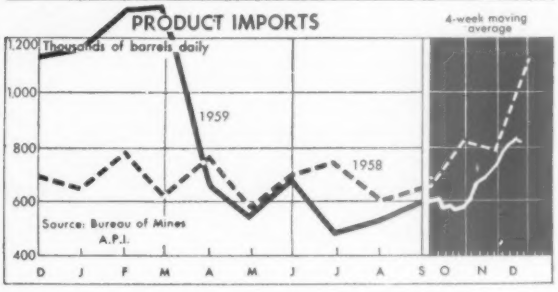

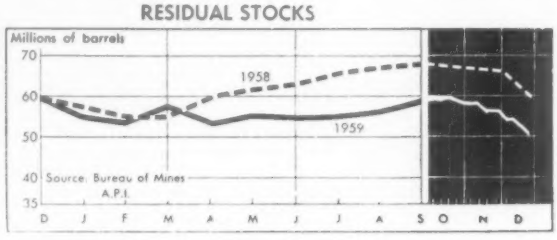

API REFINERY REPORT, DECEMBER 25, 1959
(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, December 1958—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,117	529.3	24.9	359.3	147.6	40,207	11,954	60,118	10,497	1,149	575.7	36.4	383.1	213.1
Appalachian:														
District 1 ...	103	42.6	3.7	25.0	14.3	5,905	706	4,119	362	102	42.6	5.8	20.3	12.1
District 2 ...	112	57.6	6.3	19.4	17.0	2,801	508	1,723	465	102	51.5	5.0	21.1	16.1
Ind., Ill., Ky...	1,570	782.0	71.9	351.9	194.3	32,111	5,608	23,280	5,253	1,450	738.1	70.7	335.8	205.7
Minn., Wis., Dak.	122	55.1	5.7	30.1	13.6	7,238	1,228	7,017	691	109	53.8	5.5	29.5	14.0
Okla., Kans., Mo.	707	364.6	21.4	194.7	19.4	18,277	1,283	10,839	1,113	761	427.8	17.7	203.7	37.7
Inland Texas ..	308	224.9	7.7	55.3	22.1	6,869	473	1,782	2,371	286	216.2	7.5	46.1	25.2
Tex. Gulf Coast	1,898	1,001.1	133.3	417.4	173.4	23,104	2,460	18,568	5,070	1,864	960.1	128.4	506.8	184.3
La. Gulf Coast.	746	333.3	98.7	162.0	49.3	10,011	1,347	5,867	745	665	372.8	82.9	139.3	57.2
N. La. and Ark.	108	47.1	9.1	25.3	7.7	4,527	837	2,197	183	95	48.3	4.8	22.6	6.0
Rocky Mountain:														
New Mexico.	19	12.1	0.2	3.6	1.7	859	23	233	53	25	12.8	0.7	4.2	2.4
Other Rky. Mt.	292	136.9	4.4	68.9	33.7	5,410	254	2,399	1,156	268	130.1	3.0	64.8	35.0
West Coast ...	1,164	613.1	6.4	173.7	298.9	26,726	399	13,299	22,492	1,085	515.8	5.6	177.4	295.9
Dec. 25, 1959	8,266	4,199.7	393.7	1,886.6	993.0	184,045	27,080	151,441	50,451	7,961	4,145.6	374.0	1,954.7	1,104.7
Dec. 18, 1959	8,071	4,190.1	381.0	1,859.7	989.9	182,838	27,195	156,195	52,476	.....	.....	.....	.....	.....
Dec. 26, 1958	8,165	4,157.9	374.4	2,029.7	1,141.0	181,635	26,155	130,410	61,629	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Spotlight will be off light fuel in a few weeks

KEROSINE and No. 1 fuel continue as market leaders in the important distribution areas of the country. Kerosine is strong on the Gulf Coast, but the market for No. 1 fuel in the Group 3 area is even stronger.

One Oklahoma refiner sold about 50,000 bbl. of No. 1 fuel at 0.25 cent over the Group 3 low of 10.25 cents a gallon, to be delivered in January. The price will be determined by quotations at time of delivery. If formal quotations on No. 1 continue to rise in January, the sale price will rise by an equal amount for that part of the order not delivered at the time of the increase.

No. 1 fuel on the Group 3 market is selling for the same price that is currently quoted for regular gasoline. Regular gasoline for northern shipment is bringing 10.25 cents a gallon and tends to be a little soft at this quotation. On the other hand, the above sale of No. 1 fuel at 0.25 cent over the low indicates a very strong market for this product.

However, the peak of the light-distillate market will be in January. The near-shortage of kerosine and No. 1 fuel stems from a combination of demand factors. Increases in 1959 jet-fuel sales this year were more than met out of current refinery production.

For the first 10 months of 1959, domestic demand for all grades of jet fuel increased 7.6% over the corresponding period last year. But imports of jet dropped 38%. Expressed in volumes, domestic demand gained a little more than 8 million barrels this year and the amount supplied by imports dropped 7 million barrels. Refinery production increased 15 million barrels with better than a third of the gain supplied by kerosine and distillate fuel.

The demand for jet fuel will continue its growth pattern, but refiners will take a long second look at heating-oil demand after the middle of January.

Even now, some suppliers are starting the countdown on heating oils and making final revisions in distribution plans for the gasoline season.

These normal seasonal shifts in marketing interest lead to the conclusion that it will take a long period of cold weather to boost distillate prices after the first of February.

Crude-Oil Prices

GRAVITY SCHEDULE

	Signal Hill, Calif.	Okla-homa	Gulf Coast Tex.*	West Tex.† N.M.	Wyo. (sour)
14-14.9	$1.76	....	....	....	....
15-15.9	1.84	....	....	....	$1.81
16-16.9	1.92	....	....	....	1.86
17-17.9	2.00	....	....	....	1.91
18-18.9	2.08	....	....	....	1.96
19-19.9	2.16	....	....	....	2.01
20-20.9	2.24	$2.49	....	$2.35	2.06
21-21.9	2.32	2.52	....	2.38	2.11
22-22.9	2.39	2.55	....	2.41	2.16
23-23.9	2.46	2.58	$3.44	2.44	2.21
24-24.9	2.53	2.61	3.46	2.47	2.26
25-25.9	2.60	2.64	3.48	2.50	2.31
26-26.9	2.67	2.67	3.50	2.53	2.36
27-27.9	2.74	2.70	3.52	2.56	2.49
28-28.9	2.81	2.73	3.54	2.59	2.54
29-29.9	2.87	2.76	3.56	2.62	2.59
30-30.9	2.93	2.79	....	2.65	2.63
31-31.9	3.00	2.82	....	2.68	2.67
32-32.9	3.06	2.85	....	2.71	2.71
33-33.9	3.12	2.88	....	2.74	2.75
34-34.9	3.17	2.91	....	2.77	2.79
35-35.9	3.22	2.94	....	2.80	2.83
36-36.9	3.27	2.97	....	2.83	2.87
37-37.9	3.31	2.99	....	2.86	2.89
38-38.9	....	3.01	....	2.89	2.91
39-39.9	....	3.03	....	2.92	2.93
40-40.9	....	3.05	....	2.95	2.95

*Low cold test crude. †Sour.

Effective dates of broad changes: California, 9-11-59; East of California, January 3-10, 1957; Pennsylvania Grade 9-12-59.

FLAT PRICES

Louisiana:	
Sweet Lake	$3.00
Texas:	
East Texas	3.05-3.25
Conroe	3.23-3.53
Van	3.08
Pennsylvania Grade:	
Bradford	4.40
Middle District	4.22
Southwest Pennsylvania	3.95
West Virginia	3.77
Buckeye Grade	3.62
Illinois Basin	**3.00**

FOREIGN

Canada:	
Leduc-Woodbend	2.53
Redwater (Alta.)	2.42
Smiley (Sask.)	2.18
Pembina	2.38
Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.34
San Joaquin, 41°-41.9°, Puerto La Cruz	3.08-3.10
Oficina, 35°-35.9°, Puerto La Cruz	2.80
Tia Juana medium, 26°-26.9°, Amuay*	2.30
Quiriquire, 16.0°-16.4°, Caripito	2.10
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes f.o.b. lifting port):	
Arabian, about 34°, Ras Tanura	$1.89
Iranian, 34.0°-34.9°, Bandar Masur	1.80
Iranian, 34.0°-34.9°, Abadan	1.81
Iraq, 36.0°-36.9°, Fao	1.82
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.67
Qatar, about 41°, Um Said	2.05
Middle East, E. Mediterranean:	
Arabian, about 35°, Sidon	2.29
Iraq, about 35°, Tripoli, Banias	2.29
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.57

Refined-Product Prices

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (91 octane)	10.25
Premium (99 octane)	12.75-13.00
Natural gasoline (26-70)	4.5
Breckenridge	4.0
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	10.25-10.50
Regular (92 octane)	10.50-10.75
Premium (98 octane)	11.75-12.00
California (rack) Los Angeles):	
Regular (88 octane)	11.65-12.15
Premium (94 octane)	12.65-13.15
Premium (100 octane)	14.00-14.65
Caribbean area (cargoes):	
Regular (87 octane)	10.125
Premium (97 octane)	11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
★ Kerosine 42-44	10.50-10.75
★ Diesel oil (58 d.i. and above)	10.25
★ Distillate No. 1	10.25-10.50
★ Distillate No. 2	9.50
Gulf Coast (cargoes):	
Kerosine 41-43	9.50
Distillate No. 2	8.375
New York Harbor (barges):	
Kerosine 41-43	10.30
Distillate No. 2	9.60
Diesel fuel, 48-52 d.i.	9.90
Caribbean area (cargoes):	
Distillate No. 2	8.375

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max 1% S)	$1.80-1.90
Gulf Coast (cargoes):	
Bunker C fuel	$2.00
New York Harbor (barges):	
Bunker C fuel	$2.37
Caribbean (cargoes):	
Bunker C	$2.00
California (rack):	
Bunker C fuel, Los Angeles	$2.15

Tanker Rates (Long Ton)

(Latest reported spot fixtures)

★ Gulf-USNH, clean (ATRS—5%)	$2.71
★ Carib.-USNH, dirty (ATRS—45%)	1.51
PG-UK, dirty (Scale—45%) (32s. 7d.)	4.56
PG-USNH, dirty (USMC—60%)	5.08

★ Denotes change from previous week.

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20,000' 6⅝" O.D. x .250" wall, plain end used line pipe. 30,000' 10¾" O.D. x .307" wall, plain end used line pipe. Other sizes in stock. The Buckeye Supply Company, 18 Harrison Street, Zanesville, Ohio, Phone GLadstone 2-3641.

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500,000 ft. 10¾" O.D. 35#
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100,000 ft. 12¾" O.D. 40#
20,000 ft. 16" O.D. 12#
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NEW PLAIN END DRL LINE PIPE
Domestic Mfgr.
Very Attractive Price

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80 Tanks, 5,000—10,000—30,000—55,000 & 80,000 bbl.
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- 5,000 tons Tank Plate from ¼" to ¾".
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8'6" x 103'6"—165 PSI 24 trays
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3'6" x 36'4"—400 PSI 12 trays
30" x 52'4"—360 PSI 22 trays
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7860 CFM 2 stage CENT. 153PSIG
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Steel tube ..... 7,500 to 100 sq. ft.
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Cu Ni tube ..... 2,330 to 308 sq. ft.

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STEAM—Simplex and Duplex

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12' x 50' to 4' x 10'—325 to 50 PSIG

FURNACE TUBES

33—6" x ⅜" x 27'6" Croloy 9
144—4" x 5/16" x 29' Croloy 5

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Standard Oil Refinery
Toledo, Ohio

MAJOR ITEMS OF INTEREST

2—CLARK BROS. Gas Engine Compresser Bore 13½"-Stroke 14"-McCord 4 speed lubg.

1—WORTHINGTON Centrifugal Pump #1028299, 6", type UXS-2,100 gpm, 600 rpm, 3600 against total head 2888' @ 125# discharge press. Cast steel case & nozzles. Suction nozzle-6" ser. 60 flat face-Driven by

1—MOORE Steam Turbine #4832,9 stage-Form S-202-7-4, 1050 HP. Exch. 26", vacuum, CI Case 4" steam inlet, pump used 14,490# steam per hour with 125# inlet having 26" exhaust vacuum @ 2000 rpm-comes complete with

1—WORTHINGTON Barometric Jet Condensor.

1—PITTSBURGH Automatic Lectrodryer unit, standard model BY-1-R dual absorber type, fully automatic. Max WP 150#. Seamless vertical tank, ASME construction, 500 deg. F. max temp.

37—Tanks-Drums-welded-riveted-various cap; 14 Bbls. to 40,000 Bbls.

HEAT EXCHANGERS

Quan.	Tubes	Sq. Feet
22	Steel	202-2205
42	Admiralty	170-2060
10	Chrome	212-1580
4	Brass	460-840
1	Chr-Moly	355

TOWERS

Quan.	Size	Trays
1	7' x 40'2"	14
1	9' x 40'2"	10
1	10' x 40'2"	3
1	5'6" x 38'3"	14
1	6'6" x 38'6"	6
1	12' x 73½"	31
1	5' x 31'1¾"	8
1	3' x 42"	12

MISCELLANEOUS

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31,000'—3½" I.F. Drill pipe, Grade E. Sonoscoped—From $1.25 to $3.00 per ft. Don Harman Pipe & Supply, OR 7-4343, Oklahoma City.

1—COMPLETE UNIT Rig for sale U-34 Drawworks Powered by 2 WAKBU Waukesha engines. Sub-structure. 96' Lee C. Moore Derrick. Drill pipe 4½". Drill Collars. Located in Utah. Contact M. Rumsey 330 South Socora, Wichita, Kansas. Parkview 21024. Complete inventory on request.

FOR SALE—Late model 36-L Bucyrus ERIE drilling machine with very complete tools. $13,500. Inventory of tools sent on request. Howard Jensen, 1511 Fidelity Union Life Building, Dallas, Phone RI 2-8655.

2 COMPLETE UNIT rigs for sale U-15 drawworks. 1 rig is powered by 3 NKU Waukesha engines. 1 rig powered by 2 LRO Waukesha engines. Drill pipe and collars optional. Rigs may be seen at Henson Drilling Company yard in Abilene, Texas. Complete inventory on request.

1956 MAYHEW 2,000 drilling rig, 58 foot mast on International 190 Tandem. Complete with doghouse and accessories. $20,000. P. O. Box 1049, Tulsa, LUther 2-6291.

FOR SALE OR LEASE: Three (3) large perforating trucks complete with 16,000' of 7/16" single conductor line. These units are ready for the field. Box L-614, The Oil and Gas Journal, Tulsa, Oklahoma.

MUST SELL—2,000 ft. rotary mounted on float. 1,300 ft. 2⅞ drill pipe. 1250 ft. practically new 2½ upset tubing. Practically new 5x10 Worthington pump mounted on two wheel steel trailer with 1956 Ford Industrial motor. Also 4x6 Gardner-Denver pump with Hercules motor skid mounted. 3 good trucks. Reed Wire live core barrel. Complete tools. Water pump. Very cheap at $12,500 cash. Edgar D. lling Co., 1210 Perry-Brooks Bldg., Austin, Tex.

SURPLUS GASOLINE PLANT EQUIPMENT Liquidation of one 30 MMCFD and one 60 MMCFD Absorption Plant. Bargains in pressure vessels, fractionating vessels, dehydrators, pumps, boilers, heat exchangers, instruments, generators, steam turbines, Send for list. Attn.: Mr. D. B. Harnden, Hunt Oil Co., 700 Mercantile Bank Bldg., Dallas, Texas. Phone: RI-1-3561.

TWO U-15 DRAW WORKS complete, one 2-engine chain compound w/2 NKU's priced at $13,000.00 and one 3-engine chain compound w/3 NKU's priced @ $16,500.00. One 131 ft. Lee C. Moore mast complete with 7 ft. substructure, steel flooring, 480,000 # capacity, Six 1⅛ in. sheave crown, pin type priced @ $20,000.00. One 127 ft. Moore mast complete with 7 ft. substructure, steel flooring, 450,000 # capacity, five 1⅛ in. sheave crown, bolted mast—pin type substructure priced @ $12,000.00. Also have 16 in. FXQ G-D Pump, 14-P Oilwell, and 7¼ in. x 10 in. FXQ GD w/WAK skidded as complete unit. We have complete rigs for sale or lease and terms may be arranged to reliable parties. We have 4½ in. excellent drill pipe Grade E from $1.85 per foot up. Contact us for all your requirements in rotary drilling equipment, either for export or domestic use. Call, write, or wire for further information, or for any of your specific needs. Central Tool & Rental Company, 1505 First National Bank Bldg., Phone CEntral 2-6318, Oklahoma City, Oklahoma. Liberal, Kansas Yard; phone MAin 4-6651, Box 177.

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SUPERVISORY POSITION

Large independent integrated oil company has two or three supervisory operating positions open. Must have mechanical or petroleum engineering degree. Prefer from three to twelve years experience in all phases of drilling and/or production operations. Submit full resume along with transcript of grades if possible.

BOX L-632

THE OIL AND GAS JOURNAL
TULSA, OKLAHOMA

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A DRILLING COMPANY requires an experienced driller/mechanical engineer to take charge of overseas drilling operations. Applicants must be well known in the petroleum industry and have expert knowledge of seismic shot-hole, structure and deep well drilling techniques. Please write, giving full details of qualifications and experience to: Box L-636, The Oil and Gas Journal, Tulsa, Oklahoma.

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with minimum of six years experience in Permian Basin of West Texas. Applicant must be able to do original work and generate prospects. Position is available in Denver, Colorado. Please send complete resume to Superintendent of Exploration,

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Graduate Chemical Engineer with from two to four years petroleum refining experience in process design or operations. Duties will be closely integrated with operation of a modern, independent refinery which includes crude distillation, catalytic cracking, polymerization, coking, hydro-desulfurization, catalytic reforming, alkylation, and utilities.

Send complete resume of education and experience, including salary requirements. All replies confidential.

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Ph.D. or equivalent experience to coordinate a major program in carbonate rock research in a newly established geological research section. Should have several years' experience in paleoecology and/or carbonate petrography.

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Director, Exploration Research Division
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EARLY RETIRED man 36 years major company. Refineries, gas plants, operating and general supervision. Want connection with individual or independent. L.P.G. included. Box L-640, The Oil and Gas Journal, Tulsa, Oklahoma.

RESERVOIR ENGINEER: desires position with independent oil or gas company. Presently employed by major oil company with five years experience. Desire location in Houston, Dallas, or New Orleans. Resume on request. Box L-634, The Oil and Gas Journal, Tulsa, Oklahoma.

MECHANICAL ENGINEER—Bilingual (Spanish-English) 11 years diversified design & administrative experience. 5 years domestic Co., 6 Latin America. Recently returned U.S. Seeks engr. position. Box L-626, The Oil and Gas Journal, Tulsa. Oklahoma.

SITUATION WANTED

PETROLEUM ENGINEER, married, 39, speaks Spanish, thirteen years in South America, Senior Production Supervisor, experience includes supervising cleanout rigs, compressor stations, water stations, pump stations, lease work. Will consider US or foreign employment. Box L-628, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEER and production supervisor, 28 years experience oil and gas well operations, gathering system, compressors, packaged gasoline plant. Current employment being terminated by sale of properties. Excellent health, reliable, references. Available in January. Now in west Texas. Box L-621, The Oil and Gas Journal, Tulsa, Oklahoma.

WELL EDUCATED, experienced, scout and land man seeks permanent position with progressive company. Salary, expenses and transportation expected. Will relocate. Box L-622, The Oil and Gas Journal, Tulsa, Oklahoma.

ACCOUNTANT—Presently Controller for large Texas steel fabrication plant. Position eliminated by merger. Heavy industrial experience. Two years oil production. Age 45. Box L-617, The Oil and Gas Journal, Tulsa, Oklahoma.

CHIEF ENGINEER of pipeline organization of integrated major in South America recently transferred to North Africa desires return to States. Five years domestic experience all phases natural gas pipelining. Seven years foreign experience in design, construction, operation and maintenance of million-barrel-per-day transportation system. Age 35, married, registered professional engineer Mississippi. Available six weeks notice. Box L-623, The Oil and Gas Journal, Tulsa Oklahoma.

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THE OIL AND GAS JOURNAL
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THE OIL AND GAS JOURNAL
TULSA, OKLAHOMA

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FIVE WELLS, 15 BOPD settled production. Osage County, Oklahoma. Additional locations. Excellent equipment. By owner. Box L-638, The Oil and Gas Journal, Tulsa, Oklahoma.

80A LEASE, NEAR NEW E. Kansas Secondary project—2 wells produced 12 bbls. in thirties when abandoned. Estate settling-additional acreage. 38' to 48' oil sand TD 770'. Phone CHerry 2-4682 Ottawa, Kansas.

PROSPECTIVE OIL LAND: Suitable townsite acreage in fee, E/35 acres, Sec. 16, Block JKL, PSL Survey, Hudspeth County, Texas, at intersection U. S. Highway 62 and F.M. 1437 Highway, south of Dell City, Texas. Write quickly, Jefferson G. Smith, 715 Littlefield Building, Austin 15, Texas.

OIL AND GAS MINERAL LEASES available in Dell City area of Hudspeth County, Texas. U. S. Geological Survey Map shows anticlinal axis nearby favorable for oil-gas structure. Am free landowner of over 2,000 acres. Write quickly to: Jefferson G. Smith, 715 Littlefield Building, Austin 15, Texas.

40 ACRE OFFSET—to producer 750 ft., Bartlesville sand. Montgomery County, Kansas. Will need some financial help. Have rig and tools. Box L-607, The Oil and Gas Journal, Tulsa, Oklahoma.

Large Alaskan Drilling Block

50,000 acres in Copper River Basin. Interested in making contract with drilling contractor or major company. Dry hole and bottom hole money available.

Original leases, valid 5% royalty, 1st 10 years. Each well holds 2,560 acres. Complete geological information on hand. Well is spudded 30 miles south of this block. Major companies hold all other blocks in Copper River Basin. Area is served by two hard-surface highways.

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Box 1858 Ph. DI 3-6141 Tulsa, Okla.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Santa Fe, New Mexico. Notice is hereby given that approximately 6,839.14 acres of land in thirty-six parcels within the known geologic structure of certain fields in Lea, Chaves, Eddy, Sandoval, Rio Arriba and San Juan Counties, New Mexico, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre at 2:00 p.m., MST, January 19, 1960, when bids will be opened. Details of the lease offering, how and where to submit bids, may be obtained from the Bureau's Land Office at Santa Fe, New Mexico. Douglas E. Henriques, Manager.

LEGAL

U. S. Department of the Interior, Bureau of Land Management, Land Office, 516 Second Avenue, Fairbanks, Alaska. Pursuant to the provisions of Public Land Order 1965 dated August 29, 1959, notice is hereby given that approximately 9,000 acres of land situated in the Gubik gas field, Alaska, lying north of the Brooks Mountain Range, are being offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre at 1:00 P.M., A.S.T., on February 24, 1960 when bids will be opened. This acreage, lying within the two-mile buffer zone established by P.L.O. 1621 of April 18, 1958, will be offered in separate parcels of designated leasing blocks not exceeding 640 acres each as shown on the Gubik gas field leasing map approved October 5, 1959. The map is available for examination (or purchase at $1.00 per copy) at the land offices at Fairbanks, Anchorage, and Juneau, Alaska, and at the Bureau of Land Management, Interior Building, Washington 25, D.C. Details of the lease offering and how and where to submit bids may be obtained from either of the offices named. (Robert L. Jenks, Manager, Land Office, Bureau of Land Management, Fairbanks, Alaska)

ADVERTISERS
. . . in this issue

Allis-Chalmers 28

Baker Oil Tools, Inc. 40
Black, Sivalls & Bryson, Inc. 122
Bovaird Supply Co., The 1
Bridgeport Brass Company 30

Cabot Shops, Inc. ..... Inside Back Cover
Cameron Iron Works, Inc. 126
Century Electric Company 38
Classified Advertising 138, 139, 140
Continental-Emsco Company, a Division of the Youngstown Sheet and Tube Company 23
Cooper-Bessemer Corp., The 20, 21

Darling Valve and Mfg. Co. 11
Deere, John—
Industrial Division 14, 15
Delta Tank Manufacturing Co., Inc. 65
Dowell 82, 83, 113
Drilling Equipment Manufacturing Co. 112
Du Pont 17, 18

Glidden Company—
Industrial Paint Division 27
Goodall Rubber Company 99
Goodrich Chemical Company, B. F. (GEON) 7
Grip-Tite Manufacturing Co. 112
Guiberson Corporation 26

Halliburton Oil Well Cementing Co. ..... Inside Front Cover, 8, 9, 114
Harrisburg Steel Co. 37
Homestead Value Manufacturing Company 109
Huey & Co., S. E. 107
Hughes Tool Co. ..... Back Cover

International Harvester Co. 5, 104, 105, 117
International Nickel Company, Inc., The 42

Lone Star Steel Company 100, 101

McDonough Marine Service 113
Mid-Continent Supply Company 123
Minneapolis-Honeywell Regulator Co., Industrial Division 24, 25
Mission Mfg. Company 34

Nalco Chemical Company 10
National Tank Company 142
Norris, Manufacturing, Inc., W. C. 36, 107

Oil Well Supply Division 4

Peerless Manufacturing Co. 19
Petroleum Electric Power Assn. 6
Petroleum Equipment Suppliers Association 22

Rockwood Sprinkler Company 29

Scott-Rice Company 113
Square D Company 2
Stearns-Roger Mfg. Co., The 57
Stephens Engineering 113

TeleType Corporation Subsidiary of Western Electric Company, Inc. 32, 33
Texas Employers Insurance Association 16
Timken Roller Bearing Company 119
Tube Turns Division of Chemetron Corporation 12, 13

Union Carbide Chemicals Company, Division of Union Carbide Corporation 31
United States Rubber Company 3
United States Steel Corporation—Oil Well Supply Division 4

Viking Pump Company 107

Western Company, The 103
Wichita Clutch Company, Inc. 111
Wyandotte Chemicals, Michigan Alkali Division 106

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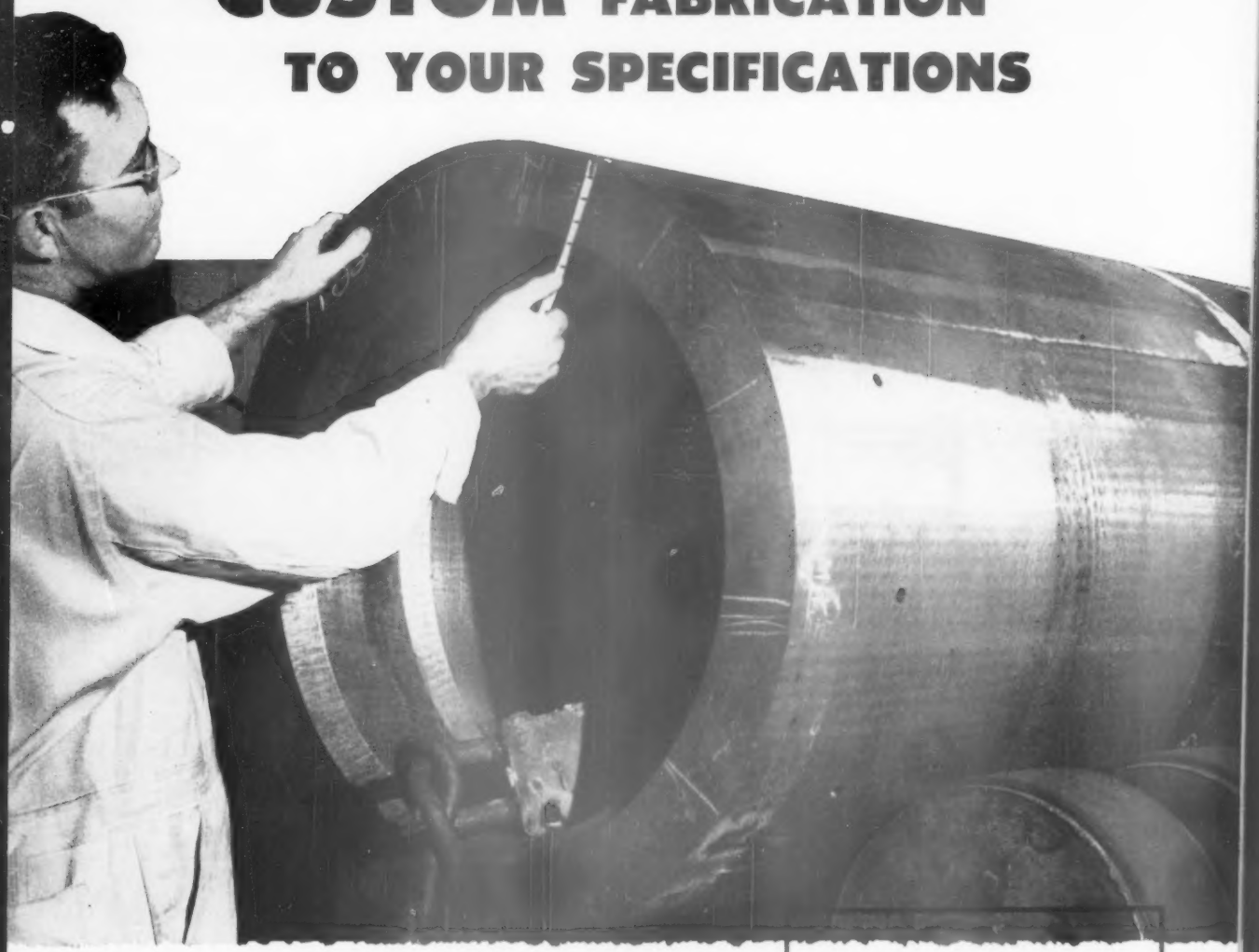

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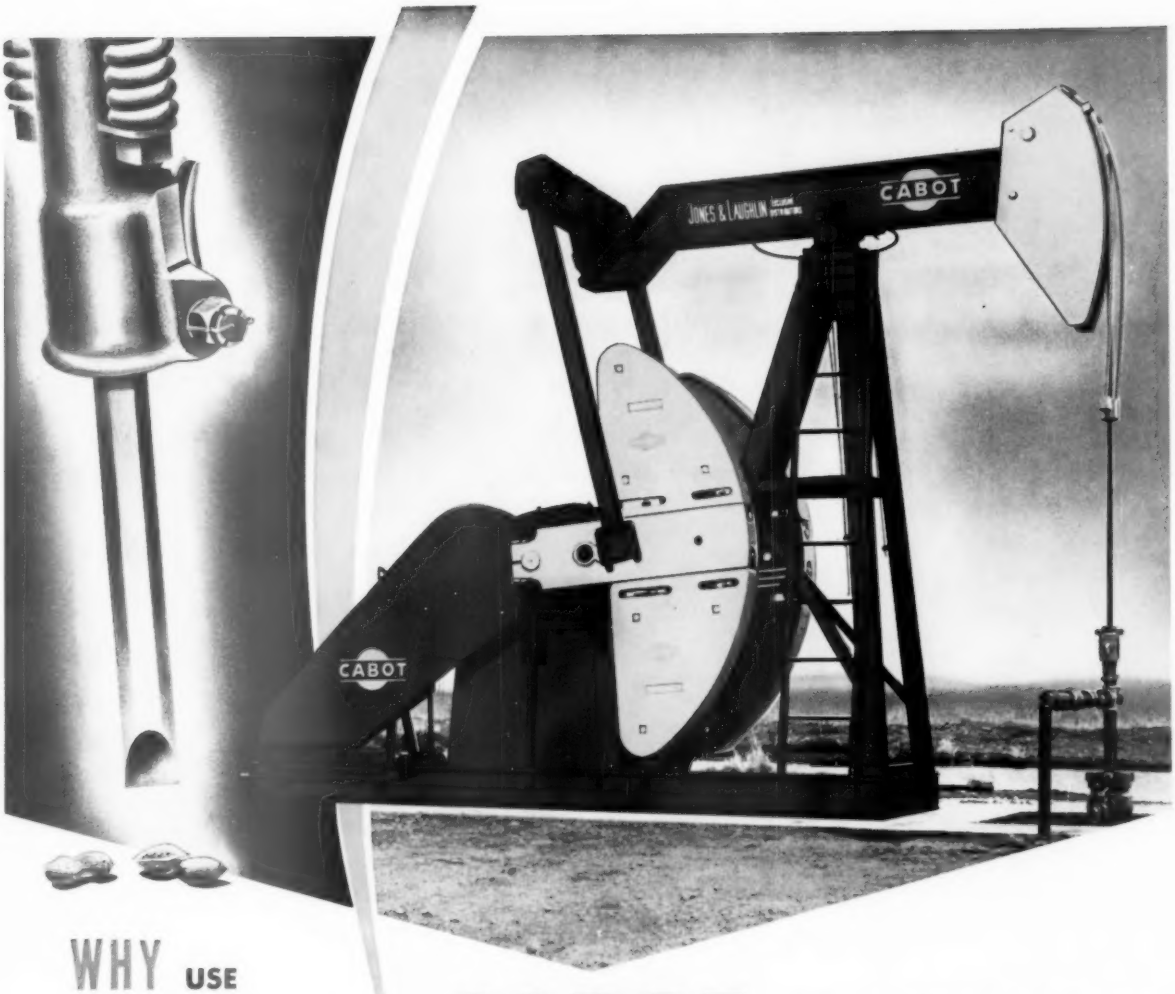

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